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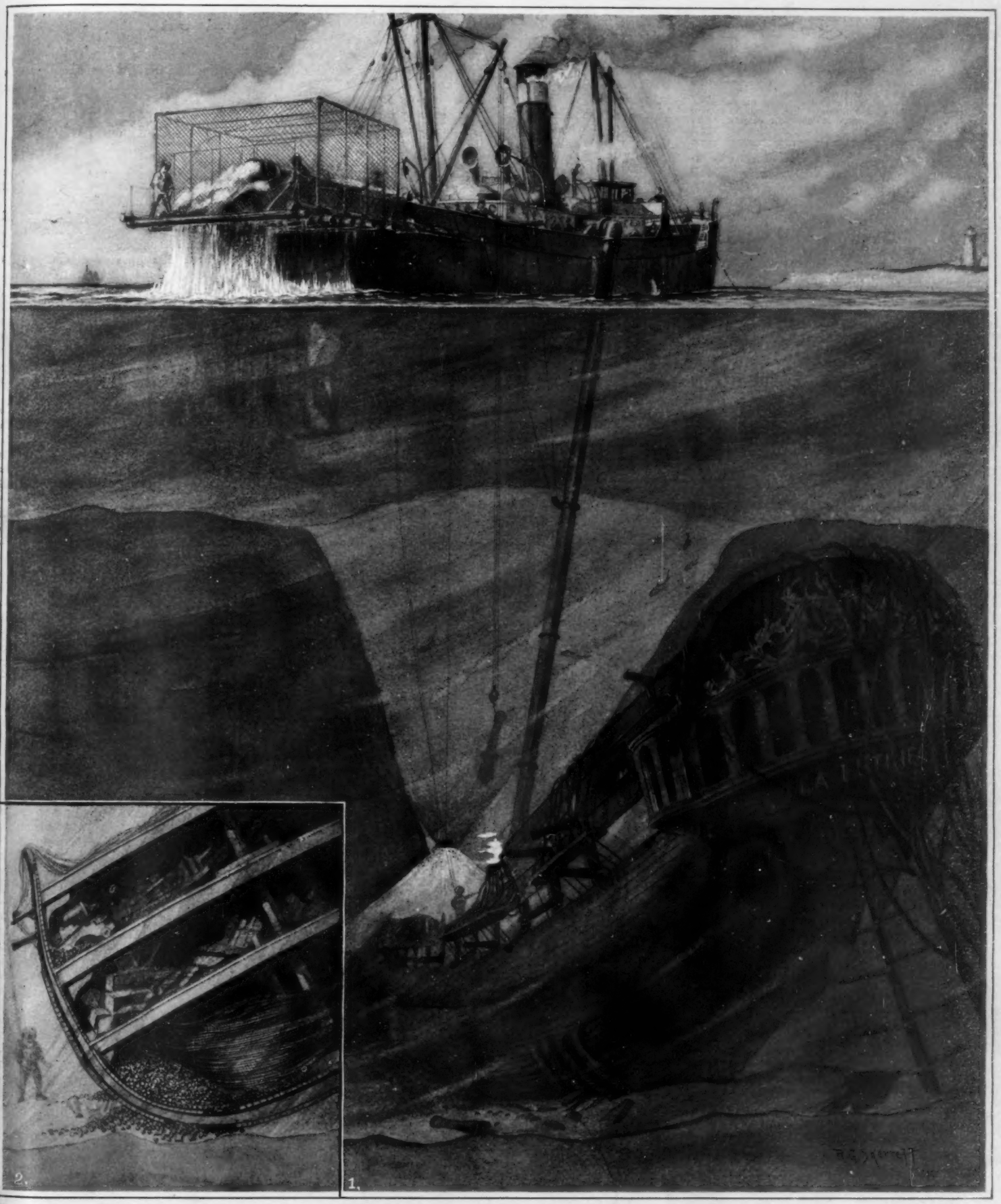

Fig. 1. A composite illustration of the wreck shortly after stranding, but buried under the present forty feet of overlying sand. This view also shows the salvage equipment now employed. Fig. 2 is a cross-section amidships showing where the National Salvage Association is now working. This view represents the "Lutine" at the time she struck. In the course of years the heavy weights have broken through the ship's side and now lie outside.

PUMPING GOLD BULLION FROM THE SEA.—[See page 473.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Fatal Omission

IT is characteristic of the ineptitude which has lately characterized the handling of the subway situation that the present plans, which contemplate the expenditure of several hundred millions of dollars, make no adequate provision for connecting the subway system with the new Pennsylvania station in this city.

We remember that one of the most important sections of the exhibit of the Pennsylvania Railroad Company at the St. Louis Exposition in 1904 was an unusually fine model of the then proposed North River tunnels and the great terminal station in the heart of Manhattan Island. The sectional model of the station showed at the easterly end of the building a four-track subway, with easy approaches thereto from the arrival and departure platforms of the express and local trains of the company.

Now when the Pennsylvania Company embarked on the vast undertaking involving about one hundred million dollars expenditure, which has resulted in giving Manhattan Island direct steam railroad connections with the West and with Long Island, it was on the understanding that the city would build a subway down Seventh Avenue; and the company received every reasonable assurance that by the time their station was completed the city would be in a position to bring to the gates of its terminal and distribute the many millions of passengers, both suburban and long distance, that would have occasion to use the Pennsylvania system.

The Pennsylvania Company have "made good"—the city has done nothing. Nay, not only has it failed to live up to a most urgent moral obligation, but in the plans for future subway extension, it has ignored the Pennsylvania terminal altogether.

The case is bad enough as regards the railroad company, but it is infinitely worse as regards the interests of the public; and when we say the public we have in mind not merely the residents of New York, but those of every city in the United States who may have reason to enter or leave New York over the lines of this company.

For the situation which confronts the traveller at the close of his journey to New York is both annoying and ridiculous. If he have any conception of the cost and importance of great engineering works (and every intelligent and informed citizen has this) he will realize, as his Pullman car sweeps through the great tunnels beneath the Hudson River and emerges in the noble station building, that only a combination of the highest engineering ability and a far-sighted and wealthy management could have planned and carried out a work of this magnitude solely for the purpose of placing the passenger, with all possible expedition and comfort, in the very heart of the great city.

Having disembarked upon the incoming platform, he naturally inquires which stairway or inclined walk will take him to the platforms of the world-renowned New York city subway. To his astonishment and chagrin, he will discover that as far as rapid transit in the city itself is concerned, he has been deposited several city blocks from nowhere. After tramping down a cross street, he will find himself, with the majority of his fellow passengers, standing without shelter from wind or weather on a street curb awaiting the next car of a not-too-frequent service. Then, after something less than a mile of strap-hanging, our grip-encumbered passenger will reach the coveted subway.

"Verily," he will say to himself, "this mountain in labor has brought forth a mouse."

This is the very anti-climax of transportation!

Nor is it sufficient answer to say that the traveller can take a "taxi." There are millions of passengers using the new Pennsylvania depot who cannot afford the "taxi," and must perforce make use of some five-cent fare system of transportation, such as the elevated or subway system. The objection is particularly strong when taxi rates stand at the present exorbitant figures.

What with plans and counter plans of rival transportation companies, of boards of estimate, of the Public Service Commission, and of individual city officials, this subway matter has gradually got itself into such a complicated "snarl," that we freely confess we long ago gave up as hopeless the attempt to keep in any intelligent touch with the situation. But of this much we are certain, that in failing to make any provision for running at least one of the subway lines through or by the new Pennsylvania terminus, the city has been guilty of the most serious blunder that it could have made.

We believe, however, that the case is not entirely hopeless, and that a way can yet be found to re-arrange the contemplated plans so as to enable travellers who wish to enter or leave New York city by way of the Thirty-third Street terminal to do so without the inconvenience, irritation and considerable loss in time which are incurred under the present conditions.

"The Last Word"

WE have received from a correspondent, who is a leading shipbuilder of this country, a clipping from one of the great London dailies, in which, under the caption of "The Last Word," its naval correspondent makes some rather startling comments on the gunnery trials of the English super-dreadnought "Orion"—the first ship to mount a battery of guns heavier than the 12-inch.

We gladly act on the suggestion, for the reason that the criticism made by this naval writer is based upon a popular error which we find to be very widely distributed. We refer to the suggestion, which amounts to a belief with a great many people, that the firing of the main battery of a warship—particularly if all the guns be fired together in a salvo—imposes such severe strain on the structure of the vessel as to weaken it even to the point of destruction. "The best brains in England," says the naval correspondent, "are perhaps unable to devise a structure capable of standing the terrific shock of ten 13.5-inch guns fired simultaneously."

Later, in the same article, this writer delivers himself as follows: "There is some reason to believe that there is truth in the theory advanced by some that, so far as our present knowledge goes, eight 12-inch, six 13.5-inch, or four 15-inch, represent the utmost broadside that we can build any ordinarily-sized ship to stand with certainty. Anything over this ratio, they say, is useful for paper comparison, and may possibly survive an action long enough to be of material service, but the time dismally prophesied in the past, when naval warfare would not mean a ship resisting the blows of the enemy so much as surviving her own gunfire, seems (possibly) near at hand."

It may be stated once and for all that this "bugaboo" of the harmful effects of the firing of a ship's heavy guns upon the ship itself is without the slightest foundation of fact. Indeed, the stresses set up in the ship as a whole by the recoil of its batteries are almost insignificant compared with those which result from the action of the sea in heavy weather.

The writer remembers how, when the "Lusitania" was being driven at 23 knots into a heavy Atlantic gale, the two slip joints where the upper deck structures had been cut through to allow for the longitudinal bending of the ship as she rode over the waves, showed a movement of fully one inch. Rough calculations showed that the flexure of the ship, considered as a beam, must have amounted to twelve or fifteen inches. Now our battleships have reached a length of between five and six hundred feet. Their decks are not cut as are those of the Atlantic liners, and it will be realized that when they come to be driven hard into a head sea, carrying, as they do, the heavy concentrated loads of the turrets, they will be subjected to stresses of an extremely heavy character.

But all of these conditions are well known to the naval constructor; and the working out of the stresses due to firing the heavy guns forms only a part of the many calculations which he makes in proportioning the different parts of a ship's structure. The energy of the recoil of a 12-inch gun is accurately known. It is transmitted from the trunnions through the girders of the gun carriage to the turntable, and from the turntable through the barbette structure to the framing and plating of the ship. All of this structural material is given such extra strength as may be necessary to take care of these recoil stresses.

During his recent stay with the Atlantic fleet, the writer took occasion, on board the "North Dakota," to go through such portions of the ship as would be most affected by the recoil and examine the paint for those cracks which in a ship are the earliest evidences of straining of the structure. This he did both after the heavy gun practice by day and practice with the 5-inch secondary battery by night, and in neither case was there the slightest sign that the structure of the ship had been affected. The ships of our navy can fire their whole broadside just as long as the ammunition supply holds out and with never a thought as to its effect upon the ship itself.

Hobbs' Theory of Continental Glaciers

AN ingenious hypothesis in regard to the history of continental glaciers and their relation to atmospheric phenomena has been worked out by Prof. W. H. Hobbs.

There are at present two of these glaciers, one of which covers Greenland and the other Antarctica. These great ice sheets differ in many important particulars from the mountain glaciers of lower latitudes. In the latter the land surface always projects above the highest levels of the ice and snow, the glaciers occupying only the hollows and troughs of the mountain slopes. The continental glacier, on the other hand, blankets practically the entire rock surface, except at the margins forming a flat dome; its model is independent of its basement; and its movement is independent of the grades of the underlying floor.

A peculiar system of winds prevails over each of the polar ice caps, in which the distribution of barometric pressure appears to play no part. The winds blow radially outward from the center of the polar continents, i. e., they flow down the ice slope, often with great violence. Usually of sufficient strength to lift the dry granules of snow a couple of feet or more in the air, when the wind develops greater strength the drifting snow rises to the height of a man, and during the characteristic polar blizzards is probably carried to heights of 100 feet or more above the ice surface; yet the direction is always and invariably outward from the center of the dome. On the other hand, the upper air currents, as shown, for example, by the drift of smoke from the volcano Erebus, in the Antarctic, and by the movement of cirrus clouds, are in the opposite direction, i. e., toward the interior of the continent. Normally drifting from the northwest, when the outward flow of surface air assumes great violence the smoke of Erebus swings around and moves directly south, with an accelerated velocity, as if the upper air was being drawn strongly inward to replace outward movement in lower levels.

These wind systems are explained as follows: Each of the great ice sheets cools the air in contact with it, and the cold and heavy air drains down the slopes of the polar continent. The upper air is drawn down in the central vortex to replace it. This air comes from a region charged with ice particles, i. e., from the level of the cirrus clouds. The descending air warms adiabatically, according to a well-known law; its ice content is melted and vaporized, only to be condensed again when the cold surface of the glacier is approached. Thus the glacier is fed entirely by the moisture of the upper air. This is the opposite of the process that occurs in the case of mountain glaciers. In the latter the surface winds blowing up the slopes are adiabatically cooled, and the glacier is fed by the moisture which they discharge.

The fine dry snow deposited over the interior of the continental glacier is continually swept down the slopes, forming the rounded, dome-like surface.

According to this view, the old theory of two polar anticyclones must give place to that of two continental (glacier) anticyclones, the centers of which—the wind poles of the earth—are not coincident with the geographic poles.

In Pleistocene times the vastly larger ice sheets must have given rise to correspondingly vaster permanent anticyclones. Direct evidence of a Pleistocene anticyclone has been obtained by Prof. Solger of Berlin, who in studying the fossil sand dunes of the North German plain, has shown that the prevailing winds at that time came, not from the west, as they do to-day, but from the east.

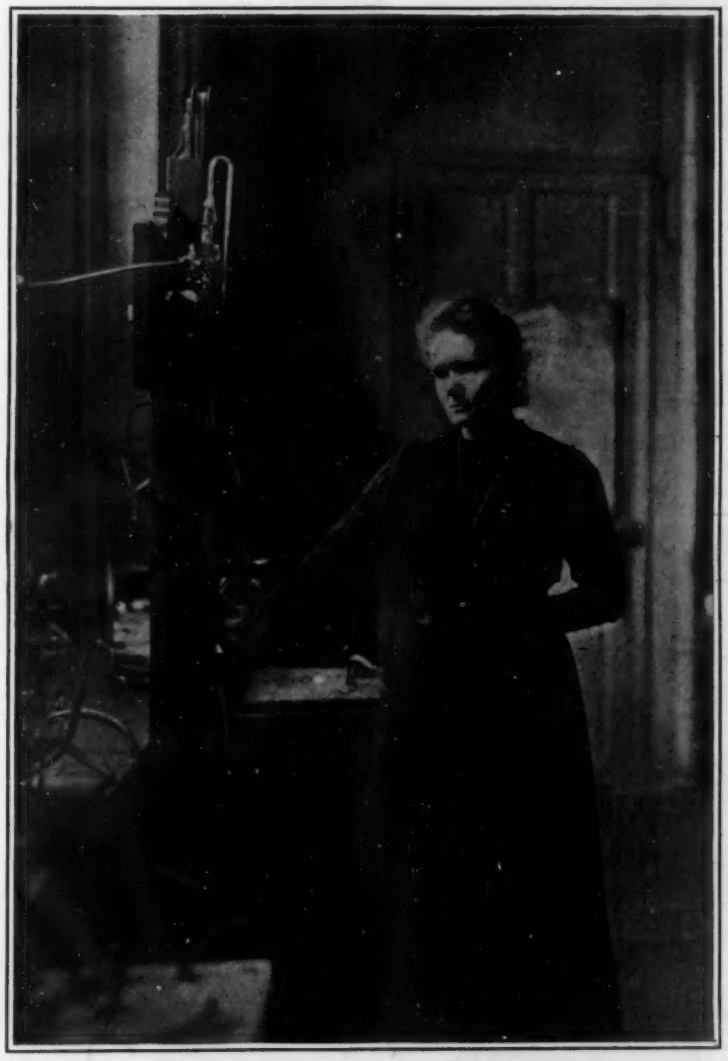
Marie Sklodowska Curie

The Greatest Woman Scientist, Twice Recipient of the Nobel Prize

FEMINISM very nearly won a great victory in the French Academy of Sciences on January 23rd, 1911, when, in the election of a successor to the deceased academician Gernez, Marie Sklodowska Curie was defeated by two votes. At a joint meeting of the five academies which compose the Institut de France, a majority had opposed the admission of women, as contrary to tradition, but each academy was left to decide the question for itself.

The Academy of Fine Arts had a few women members long ago but the Academy of Sciences has never admitted a woman. It was, perhaps, the opposition of the anti-feminists that induced Mme. Curie to apply as a candidate for the chair in the section of physics left vacant by Gernez, and formerly occupied by her husband and collaborator, Pierre Curie. In the preliminary grading of candidates Mme. Curie was placed alone, in the first grade, while her competitors, five eminent men of science, were assigned to the second grade. Mme. Curie, however, received only 28 of the 65 votes (the Academy consists of 66 members), while 30 votes were cast for Edouard Branly. There were good reasons for this choice, entirely apart from considerations of sex. Branly is a physicist of world-wide celebrity who, unlike Mme. Curie, has received few honors and emoluments. He invented the coherer for the detection of electric waves and to him Marconi's first wireless message was addressed. Many of the academicians naturally desired to recognize the very important part played by their compatriot in the development of wireless telegraphy. Moreover, Branly is sixty-four years old and this was his third candidacy, while Mme. Curie is only forty-three and had never before applied for admission. It is not customary to admit a candidate on the first application, and Mme. Curie's chance of living until the next vacancy shall occur is greater than Branly's.

Who is this remarkable woman who so nearly surmounted these formidable obstacles? The dry and formal account of herself and her work which she submitted with her application, according to custom, is perhaps more eloquent than an exhaustive biography. Marie Sklodowska was born in Warsaw November 7th, 1867. She became a student in the University of Paris where she attained the degrees of licentiate in physics in 1893 and licentiate in mathematics in 1894. In 1896 she received a certificate of fitness for the secondary instruction of girls, and in 1900 became lecturer in physics in the Ecole normale supérieure for girls in Sèvres. In 1903 she received the degree of doctor of physical science, in 1906 she became lecturer in general physics in the University of Paris, and in 1909 she was promoted to the professorship of general physics, as successor to her lately deceased husband, Prof. Pierre Curie, to whom she was married in 1895.



MARIE SKLODOWSKA CURIE

Immortalized by her researches on radium.

She is an honorary or foreign member of the Royal Institution of Great Britain, the London Chemical Society, the American Philosophical Society, the American Chemical Society, the Imperial Academy of Sciences in St. Petersburg, the Royal Swedish Academy and other learned bodies, and has received the honorary title of Doctor from the universities of Geneva and Edinburgh. In 1898 Mme. Curie, then thirty-one years of age, received the Gegner prize from the French Academy of Sciences, nominally for her extensive researches relating to the magnetic properties of iron and steel, although the report of the awarding committee also alludes, in terms of the highest commendation, to the researches in radio-activity which she had already begun, in co-operation with her husband, and to their recent discovery of the radio-active element which Mme. Curie named Polonium, in honor of her native country.

The Gegner prize was awarded to Mme. Curie again in 1900, and a third time in 1902, together with the Berthelot medal. In 1903 the Nobel prize for physical science was awarded, half to Mons. and Mme. Curie and half to Henri Becquerel, whose discovery of the spontaneous radio-activity of uranium ore formed the basis of all subsequent researches in radio-activity. Only a few days ago we heard the news that Mme. Curie has been honored with the Nobel prize a second time, on this occasion in the division of chemistry. The list of medals and prizes which have been awarded to Mme. Curie in foreign countries is too long to quote.

In addition to the numerous researches in radio-activity which she made in collaboration with her husband, Mme. Curie has published a great many independent papers, and a volume, "Investigations of Radio-active Substances," in which the results of their co-operative researches, including the epoch-making discovery of radium, are set forth.

Radium and polonium are not the only fruits of this ideal marriage, which was blessed by the birth of two children who already give evidence of inheriting the genius of their parents. After the shocking and untimely death of Pierre Curie, who was killed by a truck on a Paris bridge, in 1906, at the age of fifty-seven, a large majority of his colleagues recommended to the ministry of public instruction the appointment of his widow and coadjutor as his successor. The result is that this gifted woman, the only one of her sex who has ever received this high honor, is now a full professor in the venerable Sorbonne.

All who have seen Mme. Curie at work in her laboratory, or have listened to her lectures, have been impressed by her undemonstrative zeal, her abstraction from external disturbances and her aversion to sensational effects.

The early life of Marie Sklodowska Curie is less well-known to the general public than the later phase, in which she has become famous. And yet there is a peculiar romantic, and indeed pathetic interest attached to the incidents of her youth. Her father was a distinguished physicist, and professor of chemistry at Warsaw, Poland. Her mother died when the child was yet quite young. Marie grew up in her father's laboratory, imbibing the spirit of scientific research, and acquiring that sureness of eye and skill of hand which is so indispensable to the worker in experimental science. It is no doubt largely to her very early initiation into the technique of laboratory work that her extraordinary ability in this direction must be ascribed. Marie's apprenticeship was, however, brought to a rather early close by the pressure of necessity. As the daughter of an impecunious college professor, the eighteen-year-old girl set out to earn her own living as governess to the daughters of a Russian nobleman. But Providence had destined her for another fate. In one of those agitations which have been so common in the history of Russia, a patriotic society of students at Warsaw was brought under the scrutiny of the ever-suspicious government, and for fear of being compelled to testify against some of her father's pupils, Marie migrated from her home country and took up her abode in Paris. There she lived for a time a life of the utmost privation. Her repeated efforts to obtain employment in one of the laboratories seemed to avail her nothing. Finally she was allowed to perform some of the trivial offices in connection with the preparation of laboratory experiments. And once this meager foothold was gained, it was but a matter of days before the extraordinary faculties of the new assistant had attracted the attention and caused the amazement of the head of the department, Prof. Lippmann. The eminent scientist befriended the girl, and incidentally also introduced her to one of his most promising pupils, Pierre Curie, with whom she became associated in research, and later, in the bonds of wedlock. It was she who fanned to new endeavor the flagging spirits of her husband, in those moments of discouragement which are apt to come to all engaged in intense scientific research. And together they gained the undying trophies of fame, when, with the isolation of radium salts, the name of Curie suddenly rose to international renown. And then, not many years later, fell that terrible blow, separating the two who together had faced the hardships of everyday life, and in strangely perfect union had toiled, against much discouragement, to reap the precious harvest of scientific research. While crossing the street Prof. Curie tripped and fell, and was instantly killed by a passing truck. Thus in an evil hour France was bereft of one of her greatest physicists, the world of a genius, and Madame Curie of her life companion and husband. Her composure, upon receiving the terrible news, is commented upon by the *Gaulois*: "Nothing could have been more characteristic of the wonderful Madame Curie, than the coolness with which she received the news of her bereavement. There were no tears, no traces of grief. Over and over she repeated: 'Pierre is dead.'" One feels that here perhaps the Frenchman, with his demonstrative temperament, somewhat misjudges this great woman. The deepest emotions are not always those that can find their vent through the common channels of physical expression. To us there seems something infinitely pathetic in the monotonous repetition of that simple and sad formula, as the mind that with the insight of a genius has successfully grappled with some of the most abstruse problems presented to the science of to-day in the realm of inanimate matter, is brought face to face with the great problem of life and death. Here all men are on a level, and impartially fate has dealt to this great genius as to us all life's share of human sorrow. Yet with unbroken spirit, and with renewed devotion she turns to continue now in loneliness, her great life work, her priceless gift to humanity.

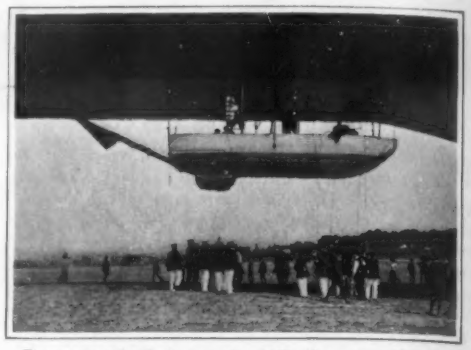
One can not help reflecting on the retribution dealt by fate to the Eastern monarchy—that makes life unendurable to the scholar of independent thought—in taking from her the woman who would have added the brightest laurel to Russia's wreath of scientific attainment.

Zeppelin's Schwaben

A High Speed Craft for Passenger Service

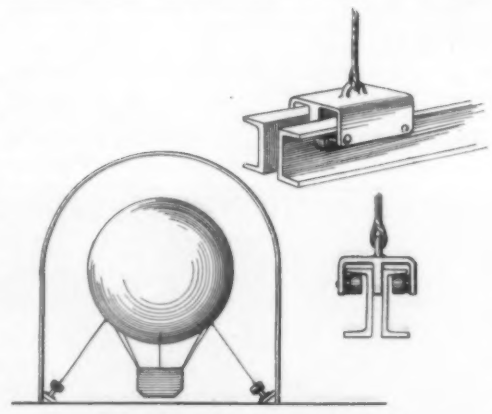
By Carl Dienstbach

Sharply pointed stern with "tail" and rudders like those of an aeroplane.



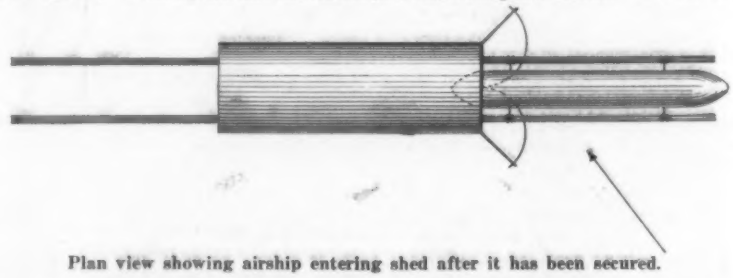
Rear car which forms the "Engine room" and holds two powerful motors.

IT is only recently that the true significance of the great dirigible dockyards in Friedrichshafen became apparent. From the early summer of 1910, till the spring of 1911, no new airship left the stocks, and when finally a second "Deutschland" put in an appearance, she looked like a mere reconstruction, showing neither greater speed nor better maneuvering qualities than the first "Deutschland," which had been shipwrecked the year before. Still there was progress in a less conspicuous but very important direction. The first "Deutschland" had come to grief because under very adverse conditions and with a motor failing at the most critical moment, she could not be kept afloat, and gradually settled into the pine trees covering the crest of the Teutoburger Wald mountains, which she had to cross at that time. To strengthen the new "Deutschland's" floating power in any similar emergency, her hull was built lighter, permitting her to carry more ballast for the same number of passengers. In addition a special test was made over Lake Constance, to show the exact amount of the lifting and depressing effect that could be obtained from her propellers and rudders alone. It was found that with only two motors and two propellers in action, the new ship could be raised by power like an aeroplane, from a static level of equilibrium at an elevation of 2,132 feet to 4,756 feet. This represents a purely dynamic lift of considerably more than two tons (4,400 pounds). With three motors and four propellers, the ship rose further from 4,756 feet to 5,904 feet, adding nearly another ton (1,980 pounds) of dynamic lift. It remained for some time at this level, carrying four passengers, its regular crew of nine, 242 pounds of fuel and oil, and more than two tons (4,400 pounds) of ballast. If one-half of this ballast had now been shed, an elevation of 7,544 feet could have been reached, while still carrying over one ton (2,200 pounds) of ballast. This proves an astonishing reserve of floating power for the arrow-like Zeppelin balloons, if their motors remain intact and they are not overloaded with passengers. What it means in warfare is shown by a simple consideration. In spite of their bulk, they are safe from artillery fire at such high levels. Their diameter is hardly greater than the wing spread of a Wright aeroplane which at the same height appears as a mere speck in the sky, and a Zeppelin at this level looks like a match, its lean shape making it a poor target. In the thin air its own speed increases; going with the strong winds of these high levels, even the slow "Deutschland" will easily surpass 60 miles an hour, making her entirely immune. Bomb dropping from aircraft becomes efficient in every respect in exact proportion to the weight of the bomb. A torpedo containing one ton of dynamite dropped from the "Deutschland" from an altitude of 8,000 feet, could be aimed with all the certainty of a shell. Air currents (and air resistance) have so little influence on this great mass that its flight through the air would be determined solely by the speed of the ship over the ground and by its altitude, both easily ascertained. Considering that a mere turn of the rudders will instantly deprive the ship of a lift of three tons, it is seen that the sudden dropping of a ton of ballast has no influence whatever on the stability of its flight. It seems odd that to-day the French depend so much on a costly chain of fortresses, which might be very efficient in preventing any repetition of the sudden victorious dash of the Germans in 1870, if the tedious hauling of heavy ordnance and building of entrenched batteries were the only means of reducing them, when in the Zeppelins the Germans now possess an instrument so efficient to bombard the "key fort" without any preparation or risk, and on the sole condition of fairly good and clear weather.

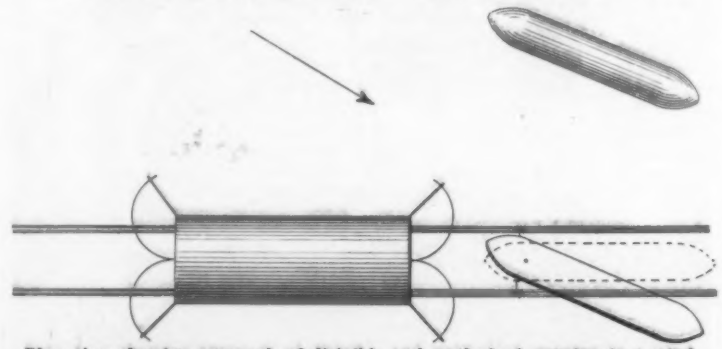


End view of airship entering shed.

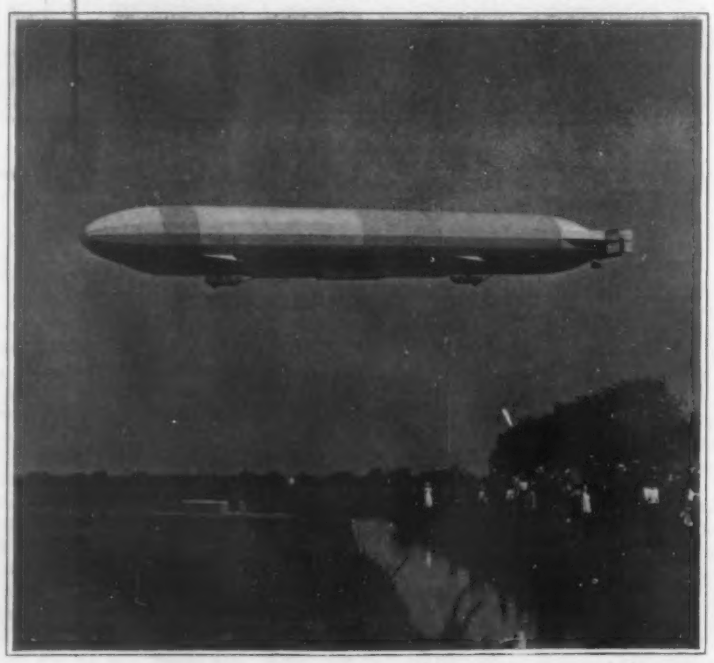
Small drawings show rails and trolleys to which the dirigible is anchored.



Plan view showing airship entering shed after it has been secured.



Plan view showing approach of dirigible and method of mooring in a wind.



The "Schwaben" traveling across country at a lively clip. The anchor ropes may be seen at the bow blown back by the wind.

NEW RIGID ZEPPELIN AIRSHIP.

Although the new "Deutschland" had been amply insured against any conditions such as destroyed the first, it was soon to fall a victim to an odd and unforeseen accident—a collision with its own shed. Trivial mishaps from lack of experience unfortunately involve a great loss of money and prestige if they happen to a large and costly dirigible instead of an inexpensive aeroplane. But in this case vindication was not long delayed. The new passenger ship "Schwaben" was almost completed when the "Deutschland" broke in two. It was a little smaller, displacing 634,500 cubic feet, instead of the "Deutschland's" 667,560; 462 feet long instead of 499 for the same beam of 46, and with 17 gas cells instead of 18. In spite of this handicap it showed a speed of a fraction less than 43 miles an hour in the trial trips, measured exactly by running in calm air many times in both directions, over a piece of straight railroad track of known length. As this speed exceeds that of most biplanes, and principally that of the representative Wright aeroplane, it revolutionizes all former ideas about the dirigible and its inferiority to the aeroplane. As a matter of fact the "Schwaben" won in a race with a Euler biplane, from Darmstadt to Frankfurt. With only two of her three motors running, it still broke all previous dirigible records, at 38 miles an hour. The great improvements in Zeppelin's ships, of which the "Schwaben" was the first brilliant exponent, concern first of all the motors. There is nothing on which the safety and success of a rigid airship depend so much as on the reliability and power of its engines. This lesson had been so well learned in Friedrichshafen that the Zeppelin factory finally undertook to design its own motors. Mr. Maybach, one of their engineers, set to work improving the standard Daimler motor, which drove the earlier ships. He increased the number of cylinders from 4 to 6 and the horse-power from 110 to 165. The reliability also was so improved that the "Schwaben's" engines have never given trouble in over a hundred passenger trips, some of which were 700 miles long. Many experiments had also been made to better the shape of the hull. The difference between the "Deutschland's" conical bow and the egg-shaped bow of the "Schwaben" is striking. To diminish friction the outer envelope of the "Schwaben" was stretched very carefully over the frame. It is so smooth and firm that non-technical observers have compared the "Schwaben's" "solid" hull to that of a warship, on account of its "gray" color. To further cut down head resistance, the time-

(Continued on page 484.)

Pumping Gold Bullion from the Sea

Recent Efforts to Salve the "Lutine's" Treasure

DURING the past summer season efforts were renewed to recover more treasure from the wreck of the old British frigate "Lutine." This waterlogged hulk has been a fascinating speculation for a good many years, and the alluring part of the project lies in the fact that no one knows just how much specie and bullion the ship carried when lost. What is known, however, is that something like half a million dollars worth of gold and silver bars and coins have been reclaimed in the course of the past century. There is every reason for the belief that the frigate had many times this treasure on board when she sailed from England on the 9th of October, 1799, and this belief has inspired the efforts made from time to time to bring to the surface the buried riches.

In the last years of the eighteenth century, plodding Hamburg awoke one morning, so to speak, to find herself the principal commercial port of northern Europe, and this sudden prominence came when she was financially unprepared to meet the exigencies of trade. Her bankers were unable to provide the funds for the prompt honoring of bills of lading, and exchange involved a discount of even as much as thirty per cent. Business could not be pushed at this rate without a ruinous loss, and the merchants of London, with the assistance of British bankers determined to relieve the stress by shipping funds to the German port. At first, it was intended to send the money in a merchant craft suitably convoyed by an armed ship; but news of this relief movement rapidly spread among the London traders and it was finally decided to dispatch the gold and silver in a man-of-war because of the amount involved. It was believed that in this way the menace of the French cruisers could best be avoided and the treasure more speedily and safely delivered in Hamburg. Accordingly, Admiral Duncan, then commanding the British North Sea fleet, detailed the frigate "Lutine"—a ship captured from the French some years before—for this service. The "Lutine" was loaded with her precious cargo secretly in order that the enemy across the Channel should not know of her mission. This secretiveness has been principally responsible for a large measure of the uncertainty which has since existed in regard to the quantity of bullion and specie dispatched. On the 9th of October, 1799, the "Lutine" sailed from Yarmouth Roads and headed north for Hamburg in the teeth of a heavy wind. By the time the ship reached the North Sea the wind had grown into a gale blowing directly toward the Dutch coast. In the gloom of that fateful night and under the pressure of the wind and the treacherous sweep of the North Sea currents, the "Lutine" struck the Dutch coast near the entrance to the Zuyder Zee. It is quite probable that none of her officers knew of her danger. She hit the sands at full speed, and immediately was thrown over on her beam's end. At the time, she carried quite three hundred persons aboard, but so sudden was the disaster that but two of this total number survived.

The morning after the "Lutine" struck, the ship had substantially disappeared from above water save for the wreckage which littered the beaches of the near-by islands of Terschelling and Vlieland. There was no one to tell how the ship happened to be out of her course nor anything as to the extent of her precious cargo. At that time, the Dutch government was an ally of France, and claimed the wreck as spoils of war so that it was quite impossible for the British to do anything toward salving the sunken property. Without going into the history of the matter, the specie aboard the frigate and most of the gold and silver bars had been insured at Lloyds' of London, and those underwriters promptly paid up. A year or two after the "Lutine" went ashore, the King of Holland gave official sanction to salvage operations upon the wreck. At that time, the hulk was not embedded in the sand and it was easy to reach it at low tide. The work was pursued by guarded fishermen using oyster tongs and other primitive implements. However, despite these handicaps, the government recovered treasure to the value of nearly $280,000. The sea did not intend to give up her riches readily, and toward the end of 1801 the wreck was completely buried by a bank of sand, which put an effectual stop to further salvage operations by means of the facilities then available. It was not until 1814 that efforts were renewed to recover the remaining treasure, but the undertaking was unsuccessful. In 1821, a company, known officially as The Decretal Salvors obtained a royal concession from Holland upon the understanding that fifty per cent of the value of whatever should be salved should be paid to the Dutch government. This enterprise was composed of Netherlanders, and is still in existence. In 1823, the British underwriters, stirred by the efforts of the Dutch company, appealed through diplomatic channels to the King of Holland. The latter, to show his friendly regard for the King of England, donated his interest in the wreck to King George IV., who, in turn, made over this gift to Lloyds' committee as a part indemnification for the loss that Association had suffered in the wrecking of the "Lutine." This point is of present concern because all salvage operations, since 1823, by British subjects, have been authorized by Lloyds' of London and, to that extent, backed by that Association. The Decretal Salvors still have their right in fifty per cent of the values recovered.

In 1857, the swirling currents at the entrance to the Zuyder Zee swept the hulk clear of sand, and at once salvage operations were renewed: diving dress being employed for the first time in the undertaking. It was not until the following year, however, that any substantial results were obtained. By the middle of October, 1858, gold and silver bars and specie were brought to the surface amounting to a value of $140,000. It did look as though the buried riches were surely to be reclaimed, but the North Sea decided otherwise, and once more hid the hulk under a heavy blanket of sand. The Decretal Salvors stuck to the task from year to year with varying results, and by the end of 1860 they had to their accumulated credit a total recovery of $220,000 worth of treasure. The bulk of this was found around the stern of the wreck and within an area sheltered by the ship's rudder, which was still in position. The salvors remained passive until 1867, and between that time and 1886, the results were too meager to pay for the labor involved. In 1886, steam, suction, shell-dredgers were engaged in the work for the first time. It was believed that it would be possible in that way to remove the overlying sand which had increased in depth over the hulk. Work in this way was pursued for the next three years—yielding various coins to the combined value of $4,600. The shell dredgers were operated each season for the following four years, but none of the treasure was brought to the surface. The various other efforts made since 1893 and until the National Salvage Association took over the task during the present year have been without result.

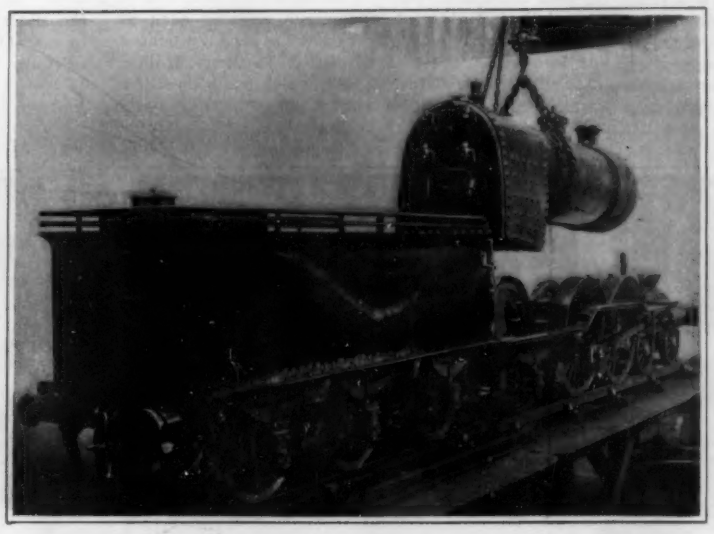
The present salvors have attacked the problem from a new point. Heretofore, all of the money and bullion reclaimed has been found lying outside of the contour of the stern of the wreck and on the side upon which the hulk rested. The National Salvage Association believe the bulk of the gold and silver to have been stowed amidships in the shot lockers adjacent to the main cable-room—the cannon balls being piled on top of the treasure. It is hard to understand what foundation exists for this opinion. As the midship section in Fig. 2 shows, the cable-room and shot lockers occupy a large space freely open to the crew by reason of the exigencies of service, and it is difficult to justify the placing of such riches in an exposed place of this sort. On the other hand, the after magazine of those old frigates was a carefully guarded room, and either that compartment or one of the divisions lying in the same after section would have been the likeliest place to hold valuables that called for continual surveillance. The fact that all of the gold and silver bars and most of the coins so far recovered have been found buried in the sand about the stern bears out the belief that the treasure was housed in the magazine or nearby.

Garden Railways

Elaborate Toys and Serviceable Miniatures on English Estates

By Percy Collins

GARDEN railways are now quite the vogue in England and their popularity is extending to other countries. The diminutive rolling stock and permanent way fall naturally into two groups, viz., those which are too small to be regarded as anything but elaborate toys, and those which possess sufficient power and stability to accommodate passengers and freight. An important event in the history of garden railway engineering was the standardization of gages. Now-a-days model railway work is based upon recognized standards which cannot be altered. There are four small gages, ranging from 1½ inches to 2½ inches, and six large gages ranging from 3½ inches to 15 inches. Models produced by leading firms accommodate themselves to one or other of these gages, while amateur workers, for their own convenience, adhere strictly to the same standards. In each gage a multiplicity of accessories made to scale, such as stations, signal-boxes, bridges and level crossings, are obtainable. The smallest gages of all are specially suitable for indoor work, but the 3¼- and 3½-inch gages are both popular where outdoor railways are concerned, each having its own circle of votaries. Several elaborate systems in the latter gage already exist, the most notable being the "Great Holmwood Railway," at Thorp, Norwich, the property of Col. J. R. Harvey, by whose courtesy we are able to reproduce the accompanying photographs. A brief description of this system will give the reader an idea of the possibilities for pleasurable occupation which a garden railway offers. The main line is a continuous single track, 350 feet long, which passes round a lawn. The permanent way is laid on a brick foundation, about three feet from the gravel walk, in order to obviate the necessity for stooping when attending to the models. The curves are all 14 feet radius, and there are gradients of 1 in 40, 1 in 60, and 1 in 70, the remainder of the line being level. Including sidings, there are some 600 feet of track, the laying of which necessitated the



Lowering the heavy boiler into place on a model G. N. R. Atlantic type locomotive.

A 15-inch gage locomotive on the Rhyl miniature railway.

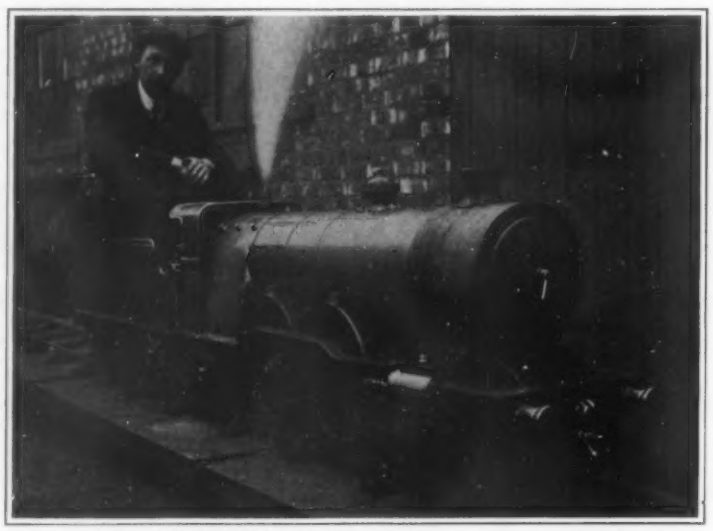
Gasolene locomotive built to resemble a steam locomotive.

Getting ready for the day's work.

use of 7,200 chairs and 10,800 brass screws. There are three through loops, eight sidings, four principal stations, three bridges, two tunnels, an engine-shed and turn-table, and seven running-sheds, five being 18 feet long, and two 8 feet long. There are two pits for firing up, one having the rails hinged to drop for convenience in getting at the burners of the locomotives, also a tank with distilled water supply, and a complete system of signals, points, and footlights. A "third rail" has been laid down over the entire system, so that the whole line is available for electric traction. The permanent way was ballasted with "blue billy" obtained from the local gas works—a wise precaution against the growth of weeds. All the bridges which span the garden paths are so constructed that they may easily be lifted up. The steam locomotives of the "Great Holmwood Railway" comprise a four-wheel coupled outside cylinder bogie tender engine, a four-wheel coupled bogie tenwheel tank-engine with outside cylinders, a four-wheel coupled inside cylinder tank-engine, and a four-wheel shunting engine. The electric models comprise a tube locomotive fitted with a special design of motor by Messrs. Marshall & Wood, a four-wheel coupled tank-engine fitted with an Avery motor, and a Great Northern Railway single express engine, equipped with a motor in the tender as well as in the engine.

The rolling-stock includes some forty odd vehicles, ranging from a platelayers' trolley to a mail coach and sleeping and dining saloons. There are open trucks, closed trucks, crane trucks, tipping contractors' wagons, goods and passenger "brakes," with types of various other vehicles, all being fitted with central buffers, which are never found to interlock when the train is passing round curves. A speed of eight miles an hour has been attained on a measured length of this railway, while the locomotives are capable of pulling with ease a train of thirteen coaches.

Another noteworthy railway is the property of Mr. G. S. Mitchell, of Sheffield. It has a gage of 7¼ inches, while the "inner circle" is laid also with a 3½-inch gage track to accommodate the owner's smaller models. The length of the main line is 439 feet, of the inner line 330 feet, while there is also a connecting line of 62 feet, and an engine-shed line of 110 feet. Upon leaving the shed, the locomotive passes down a steep gradient into a cutting four feet deep, from which over 100 cartloads of earth were removed. It then enters the 25-yard-long tunnel, which is the chief engineering feature of the line, built, as it is, of brick throughout, on proper drums, with 14-inch side-walls and arch bricks for roof. The tunnel is properly drained, and the bank through which it passes consists of about 200 tons of earth. The line emerges near "South Junction," the branch for the "inner circle," which passes round an ornamental lake. A very perfect system of signalling has been instituted. Sixteen signals are in use, and all of them are duly lighted when the line is used after dark. There is a properly-equipped signal-box, and by obeying the ordinary laws of signalling and by codes of flag-signals—red and green lamps at night—and engine whistles, the safe control of the line may be achieved without the interchange of a word between driver and signalman. Mr. Mitchell's locomotives comprise a 3½-inch gage tank-engine, a 3½-inch gage Great Northern Railway model, also a 7¼-inch gage "Precursor" locomotive, built from designs by Mr. Greenly. All the engines are fired with a mixture of three parts coke and one part anthracite coal. The rolling-stock includes a large double bogie wagon and a ballast truck, as well as a 3½-inch gage driving truck, with water and coal space, for use with the small locomotives.



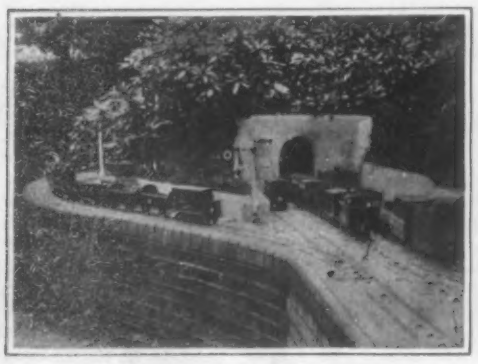
A 2-inch scale 9½-inch G. N. R. locomotive, shown in process of construction on the previous page.

A few enthusiasts, with the necessary space and cash at their disposal favor the 9½-inch gage, with models made to a scale of 2 inches to the foot, that is, one-sixth full size. A photograph showing such an engine undergoing its "works test" is here reproduced. It is a scale model of the Great Northern Railway "Atlantic" locomotive No. 1442, which hauls the Royal train. When in full working trim, the model—the boiler of which is made of copper throughout, and fired with ordinary coal—weighs 950 pounds. In favorable circumstances it will pull a load of two tons, and travel at a speed of seventeen miles an hour. It may interest the reader to know that the cost of such a model, capable of pulling himself and his friends in specially-designed passenger trucks, would be about £300.

The so-called light railways, with a gage of 15 inches, accommodate models built to a scale of three inches to the foot. When space permits, and when the additional cost is not a barrier, this gage will certainly be found to constitute, in practice, the ideal for a garden railway. This was the gage employed by Sir Percival Heywood when he constructed the famous "baby" railway on the Duke of Westminster's estate, at Eaton Hall in Cheshire. Roughly speaking the line cost about $6,500 per mile to construct, exclusive of the various buildings and other paraphernalia. It connects Eaton Hall with Balderton Siding, on the Great Western main line, some four and a half miles distant, and is almost exclusively used for freight, though the rolling-stock includes one passenger coach—an eight-wheeled carriage capable of accommodating sixteen persons—in which visitors to the Hall, including Royalty, occasionally travel. The trains on this railway carry, on an average, some 6,000 tons each year, and travel from 4,000 to 5,000 miles.

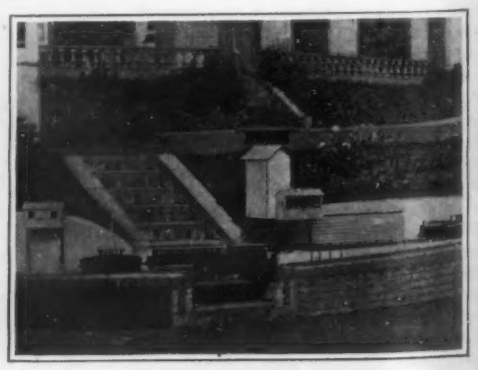
The original locomotive of the Eaton Hall Railway is known as "Katie." Her cost was £400, and she was designed and constructed by Sir Percival Heywood. More recently a locomotive of the "Atlantic" type, appropriately called the "Little Giant," was tried on the line. This engine was constructed by Messrs. Bassett-Lowke, and proved capable of hauling 12 tons on a level at four miles per hour, and five tons at 15 miles per hour up gradients of 1 in 100. With 2½ tons behind it on a falling gradient, it attained the enormous speed of 26½ miles per hour, equal to a scale speed of more than 100 miles per hour. In matters of detail, this engine and its duplicates represent the high-water mark of model engineering.

The Eaton Hall Railway is not, of course, required to prove itself financially profitable; but the 15-inch gage is being exploited commercially at the present time. In November, 1904, a limited company, styled the Miniature Railways of Great Britain, was formed to operate tiny passenger systems. The first of these railways was built on the south shore at Blackpool. It met with immediate success, and has since been followed by similar railways in Sutton Coldfield Park.



A junction at the entrance to a tunnel.

The permanent way around the lake.



Electric train passing over a lift bridge.

GARDEN RAILWAYS

near Birmingham, the International Exhibition at Nancy, in France, and the Shepherd's Bush Exhibition in London. More recently the company has laid down miniature railways in the Zoological Gardens and Park near Halifax, and in the grounds of the International Exhibition at Brussels. Among other notable garden railways is that laid down by the Rev. J. E. Preston in his vicarage garden at Julianstown, Drogheda, Ireland. Mr. Preston has made with his own hands the sleepers, locomotives, carriages, points, and signals. He also prints and issues his own tickets

The gage of the railway is 1 foot 9 inches, and consists of about five tons of rails, 14 pounds to the yard. Though "miniature," it is large enough to carry its constructor and his friends round the grounds.

Apart from the successes which these miniature railways have scored at pleasure resorts, no reasonable doubt can be entertained that, where land is available, they would prove equally profitable for the conveyance of passengers and goods from railway stations to outlying districts. Permanent way materials, which include steel rails—weighing 12 pounds to the yard—fixed to steel corrugated sleepers by tips and dogs, all necessary fish-plates, bolts, nuts, etc., including bending, and four sets of switches, would cost in the neighborhood of $1,800 per mile. To this must be added the cost of construction which would vary according to the nature of the land over which the railway was laid. The approximate cost of an "Atlantic" type locomotive would be about $1,600.

It remains to be said that the photographs reproduced on these pages give a genuine idea of the power possessed by these diminutive locomotives.

Science

Disastrous Typhoon in Formosa.—Consular reports state that the worst typnoon experienced in Formosa for fifteen years swept over the island on August 31st. In the city of Taihoku, alone, over 2,000 houses were completely wrecked, fifty-eight people were killed outright, and twenty-nine others lost their lives in a railway bridge accident. The sugar-cane crop of the island was injured to the extent of 20 per cent, and the rice crop 15 per cent.

Ventilation as a Protection Against Frost.—To the long list of the means heretofore proposed of protecting fields, orchards and vineyards against frost a new one has recently been added by M. F. Chavernac. Writing in *Progrès agricole et viticole*, he points out the fact that frosts are not feared when the wind blows; he is thus led to suggest the creation of an artificial wind by the installation of electric fans among the plants to be protected. He considers this plan applicable chiefly to vineyards, but also possibly useful in orchards.

Sugar from the Nipa Tree.—According to Dr. H. D. Gibbs, of the Philippine Bureau of Science, the nipa tree—already so useful to the Philippines and the East Indies generally as a source of thatching, matting, cigarette wrappers, toddy, and an edible fruit—promises to revolutionize the sugar industry of the islands, as its sap yields a sugar of superior quality. Samples tested in his laboratory polarized at 96.8 per cent, a gain of 8 per cent over the highest quality now exported from the Philippines. While sugar made from palm trees (of several species) is no novelty, the product has heretofore been unimportant in the world's markets.

Agricultural Education in Korea.—One example of the enlightened policy of the Japanese in dealing with their new possession, Korea (now officially called Chosen), is seen in the great progress of agricultural education in that country. Since 1906 the authorities have established thirteen agricultural schools and fifteen model experimental farms, the oldest and most important being the station at Suwon (Suigen), which is excellently equipped and managed, and compares favorably with some of the best institutions of this character in the United States. From this school there are 98 graduates who have taken the full three years' course, while 37 students have taken special shorter courses.

A Spanish Polar Expedition.—Several recent occurrences in Spain have betokened an awakening, in that country, of interest in scientific matters. Accordingly we are not surprised to hear that the Spaniards are planning an arctic expedition. The project was submitted to a recent meeting of the Royal Geographic Society of Madrid by F. J. Gisbert, who has had some experience in polar exploration, and a committee has been appointed to raise the necessary funds, which it is estimated will amount to $125,000. Senor Gisbert proposes to drift for three years in a trans-polar current—*à la* Nansen—starting from a point north of the Alaska coast, in 160 deg. west longitude, whence he expects to reach the Greenland Sea. Side trips are to made on sleds, in order that exploration may cover a zone of 100 miles on either side of the ship's position.

The City of Dairen, formerly called Dalny, is said to be the most up-to-date town in Manchuria. Here the Japanese are spending large sums annually on street, sewer and lighting improvements. Good hotels are maintained by the South Manchuria Railway (which is a semi-official organization). This line now runs express trains four times a week to connect with the trains of the Siberian Railway; they are unsurpassed in the Far East, being equipped with Pullman coaches, dining cars, and sleepers. The railway also operates a twice-a-week steamer service to Shanghai. The wharves of Dairen are said to be the finest in the Far East, vessels drawing up to 28 feet being moored alongside the quay. The port is open the year round, as the ice that forms in the bay is never thick enough to interfere with navigation. During the year 1910 1,369 steamers entered this port with cargo, and 487 in ballast, their tonnage aggregating 1,637,719.

Electricity

Wireless Telegraphy in the South Seas.—Wellington, New Zealand, will soon have one of the most powerful wireless telegraph stations in the world, with a radius of action of 1,000 miles. The government of New Zealand also intends to establish medium-power stations at the Chatham islands, a small group 600 miles southeast of Wellington, and at Raratonga, in the Cook group. As the latter will be able to communicate with Tonga, New Zealand will be within reach of Fiji.

Fender Chains for Panama Canal Locks.—In order to protect the gates of the Panama Canal locks, heavy chains are to be stretched across the lock chambers to receive the impact of vessels which get beyond control. These chains will be raised and lowered into grooves in the masonry by means of hydraulic mechanism. The hydraulic system will be controlled by solenoid valves, which will admit the water pressure to the cylinders. By using valves of this character, the chains may be controlled electrically from any desired central point.

Motor Trucks Need No Rest.—In a paper read before the Electric Vehicle Association of America, Mr. Hayden Eames called attention to the fact that horse-drawn vehicles must remain idle for a certain portion of the day in order to rest the horses. A recent investigation showed that the teams of the different express companies in New York city were idle forty per cent of the total working hours, much of this idleness being due to the fact that the horses needed rest, and that the periods of loading the wagons had to be suited to these rest hours. The motor vehicle on the other hand requires no rest, and hence requires no adjustment of the loading hours.

Electrically-cured Meat.—Some time ago we described in these columns an electrical method of curing hams, which was discovered by a Cincinnati packer. He found that by introducing an alternating current through the pickling brine the hams could be cured in from 30 to 35 days, as against 90 to 100 of the ordinary method. A large plant in Cleveland, Ohio, is now curing meat by this process. Ten 5,000-pound vats are in service. The current is furnished by a 100-kilowatt generating plant. The plant generates direct current for use in various capacities, and a portion of it is converted into alternating current by means of a rotary converter, to provide the energy used in the curing vats.

Resistance of Silicon at Various Temperatures.—Writing in the *Physical Review*, A. A Somerville points to the fact that the resistance of the majority of metals increases steadily with the temperature up to their melting point, at which point there is a very sudden rise in resistance. Silicon, however, acts very differently. From zero to 350 deg. Cent. the resistance decreases gradually, and above this point, up to 500 degrees, it increases, reaching a value nearly equal to that of ordinary temperatures. Above 500 degrees the resistance rapidly decreases again. This curious phenomenon was observed in a large number of tests, showing that the result was not due to any peculiarity in a particular specimen, but was a property common to silicon.

Electrically-driven Road Roller.—A contractor in Independence, Kan., has had an electric road roller constructed for his use. The road roller is driven by a 10-horse-power motor, which obtains its energy through a flexible cable, 160 feet in length, connected to a transformer mounted on wheels. This in turn is connected with the supply system of the neighborhood, obtaining current at a voltage of 2,300 and slipping it down to 220 for use in the motor of the road roller. These flexible cables give the road roller sufficient radius of action for ordinary purposes, but when it is necessary to operate at a considerable distance from the only available transmission line, a temporary power transmission line is constructed very quickly. The cost of operating this roller in connection with the laying of brick pavements has been $6 per block. This amount covers the process of rolling the ground before and after the bed of crushed rock has been applied to it, and then rolling the brick after it has been laid upon the rock bed. The motor-driven roller weighs altogether 15,000 pounds.

Aeronautics

A Powerful Two-motor Monoplane.—Some months ago, in competition for the Gould-Scientific American prize, the Queen Aeroplane Co. produced a twin-motor monoplane fitted with two 50-horse-power Gnome motors. Piloted by Arthur Stone, this machine flew at Nassau Boulevard, but came to grief at the first turn. Short Bros., in England, recently built a two-motor biplane having the same equipment as the monoplane just mentioned, but it remained for a French engineer, M. Legrand, to bring out a biplane racer with two 100-horse-power Gnome motors. This machine was flown successfully by Camille Guillame at Juvisy on October 20th last. The Coanda biplane which participated in the military contest recently also had two motors and a bevel gear drive to the propellers.

Rodgers Has a Bad Fall in California.—Trans-continental aviator C. P. Rodgers, after a week's rest at Pasadena, attempted to fly the remaining 25 miles of his journey on the 12th inst., and to land at Long Beach. He had gone but a few miles when he was forced to alight at Cobina Junction because of engine trouble. After making temporary repairs he flew on again as far as Compton, where, in making a forced descent, he fell 100 feet, sustaining concussion of the brain, severely sprained ankles, and internal injuries. Rodgers' mind was a blank for thirty hours. He has since explained his fall as a result of sleepiness which overcame him when flying at a height of 1,000 feet. He attempted to descend, but when 100 feet from the ground became unconscious and lost control of the machine.

Test of Vaniman's Airship "Akron."—After a considerable delay, the first test flight of the "Akron" took place at Atlantic City on November 4th. Manned by her full crew of five, the airship maneuvered for more than an hour above the inlet at Atlantic City. A strong breeze arose, and the airship was progressing against it splendidly when Vaniman fell across the rubber hose connecting the motor with the radiator and broke it. Knowing that the motor was about to stop, Vaniman steered his vessel down head on into the shallow water covering a mud flat. Not until the tide rose were the motor boats able to rescue the disabled airship. A 70-mile gale on the 12th inst. damaged the "Akron's" shed, but the craft itself was not injured. Vaniman has given up the idea of making the trip this year.

Recent Aeronautic Fatalities.—By a strange coincidence of fate a parachute-jumper, a celebrated balloonist, and a well-known aviator met their deaths within a few days in widely diversified ways. When he cut loose from his balloon 3,000 feet in the air at Guthrie, Okla., on November 10th Samuel Hellar's trapeze bar broke. He managed to hang on until within 200 feet of the earth, when he fell and was killed. Edgar W. Mix, the American electrical engineer and balloonist, who won the Bennett Cup race in 1909, committed suicide by jumping overboard from a channel steamer on the 12th inst. Herr Pietschker, a well-known German pilot of the "Albatross" biplane, fell to his death at Johannisthal, near Berlin, on November 15th. His neck was broken.

Robinson's Flight Down the Mississippi.—After a week's delay owing to stormy weather, Hugh Robinson, with his Curtiss hydro-aeroplane, ascended from the surface of Lake Calhoun at Minneapolis on the 17th ult., and started on his proposed flight to New Orleans. With the wind behind him, he flew 110 miles to Winona, Minn., in 1:28, or at the rate of 88 miles an hour, where he landed in the Mississippi river. In landing he struck a snag and damaged his hydroplane float. On October 19th he covered 91 miles in 83 minutes—an average speed of 65¾ miles an hour. His flight down the river was terminated at Rock Island, Ill., the next day, as the different cities which had given him guarantees withdrew them when they found he would probably make the flight without. He set a new record in that he carried mail for over 300 miles and collected and dropped off letters at the various towns at which he stopped. His flight is the longest ever accomplished with a hydro-aeroplane.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Floods Caused by Over-grazing

AMONG the recent publications issued by the Forest Service is Bulletin 91 entitled "Grazing and Floods; A Study of Conditions in the Manti National Forest, Utah," by Robert V. R. Reynolds, Forest Examiner. The bulletin consists of a recital of the triumphs of strict protection of the cattle and sheep range on a typical region subject to floods and erosion. The facts brought out in this publication plainly show that the absence of floods in the Manti National Forest can be attributed only to the protection afforded by the excellent crop of forage on the area closed to grazing.

"The Manti National Forest in central Utah has for a number of years been subject to severe floods after all storms of more than usual violence, with corresponding scarcity of water during periods of drought. A careful study made during the spring and summer of 1910 showed clearly that this condition of erratic run-off had followed heavy overgrazing in the mountains, and that where grazing had been restricted the conditions were rapidly improving. The problem of securing an equable streamflow is a vital one to the towns located along the base of the Wasatch Range. These are not only dependent upon the streams for their water supply, but they have also suffered heavily from floods in the past and are still constantly in danger." Again: "In 1910 a committee composed of two sheepmen, two cattlemen, and a merchant, representing the towns of Orangeville and Castledale and surrounding agricultural settlements in Emery County, expressed the belief that floods are due mainly to the denuded condition of the range which has resulted from over-grazing, and requested the protection of these watersheds. In support of their request they stated that for many years after the settlement of Castle Valley in 1878, floods were unknown. Soon after the ranges on the heads of the streams were heavily stocked with sheep and cattle, however, freshets began to occur with each heavy rain during the summer months, and these have steadily increased in volume and destructiveness."

Mr. Reynolds contrasts the former conditions of grazing, distinctive in most of its aspects, with the well regulated methods now generally in vogue on all the principal water sheds where the government still holds title to the land. The period of strict grazing supervision is one of the most remarkable epochs in the history of forestry and conservation.

Until one examines the entire ground carefully it is impossible to see why the Forest Service annually comes to Congress as a solicitant of favors. It has the right to demand support. This support it does not always have because its work in some parts of the West often runs counter to organized sheep and cattle men. Formerly it was the fashion in the West to ridicule the work of the Forest Service as being largely theoretical, and perhaps a part of the earlier work was fair game for the humorist in that day, but that day is past and great results are being accomplished. One is obliged to admit that the triumphs of the Forest Service have been many and that a large part of its success is due to the original work of the ambitious young men who have entered the service during the last ten years and whose painstaking endeavors are beginning to bear fruit.

The effect of erosion as a result of over-grazing.

A large band of sheep in corral.

Boulders carried down by floods brought on by over-grazing the higher land.

The Earning Power of Chemistry

IN a public lecture to business men, delivered recently under the auspices of the Indiana Section of the American Chemical Society, Mr. Arthur D. Little claims for chemistry that it is the most fundamental and likewise the most comprehensive of all the sciences.

Among the practical applications of chemical research, Mr. Little mentions the work done by Brown and Mrs. Richard in the laboratory of the Massachusetts Institute of Technology, "work which has been the means of saving countless lives throughout the world and has led to such understanding and made possible such control of sources of pollution as to almost justify the statement that for every case of typhoid fever some one should be hanged."

Mr. Little assures us that chemistry can now determine in advance the suitability of a given water supply for use in boilers or for the requirements of any special line of industry, as paper-making, dyeing, cloth finishing, brewing and so on.

"Chemistry pervades the packing industry, reducing the cost of food by utilization of by-products of the most varied character, from oleomargarine to glycerine and soap and from soap to pepsin and adrenalin.

"Carbon disulphide made in the Taylor electric furnace has preserved the wine industry of France by destroying the phylloxera, as it is ridding our own fields of prairie dogs and our elevators of rats and mice. Bread-making and brewing are coming each year more and more within the recognized domain of chemistry, which is at the same time greatly enhancing the value of our staple crop by the increasing production of glucose, corn oil and gluten. Exactly one hundred years ago Kirchhoff discovered the inversion of starch to glucose by dilute acids. To-day the United States alone is richer by $30,000,000 a year by reason of that discovery."

Among other instances of the commercial utilization of chemistry Mr. Little mentions increased crop yields by proper fertilization, increased profits by utilization of the cotton seed for oil, cattle feed, adaptation of the short fiber adhering to the ginned cotton seed hull to the making of smokeless powder and the stalks of the cotton plant to paper-making.

There are also to be considered wool degreasing processes which convert wool grease into oleic acid, soap, lubricating oils and potash and ammonia salts; the carbonization of cotton fabrics; the wonderful processes whereby coal tar is made to yield perfumes, dyes, aseptics, explosives, photographic developers and a host of other substances; the modern development of artificial silk from cellulose, the manufacture of artificial horsehair and of artificial bristles composed of cellulose acetate; the production of illuminating gas; the introduction of the modern gas mantle of the Welsbach type; the chemical research which has resulted in improving the incandescent lamp, so that in the last ten years there has resulted a saving of twenty-four million dollars a year in the cost of lighting, as compared with the cost of equal illumination by the older types of lamp; the analysis of flue gases, so as to save fuel.

Mr. Little concludes with a quotation from Prof. Robert Kennedy Duncan:

"During the next five years the small manufacturer who is swept out of existence will often wonder why. He will ascribe it to the economy of large scale operations, or business intrigues or what not, never knowing that his disaster was due to the application of pure science that the trust organizations and large manufacturers are already beginning to appreciate."

Eye Color and Mental Traits

IN reviewing in *Science* the third edition of Punnet's little classic "Mendelism," W. E. Castle cites the following interesting passage:

"A discussion of eye color suggests reflections of another kind. It is difficult to believe that the markedly different states of pigmentation which occur in the same species are not associated with deep-seated chemical differences influencing the character and bent of the individual. May not these differences in pigmentation be coupled with and so become in some measure a guide to mental and temperamental characteristics? In the National Portrait Gallery in London the pictures of celebrated men and women are largely grouped according to the vocations in which they have succeeded. The observant will probably have noticed that there is a tendency for a given type of eye color to predominate in some of the larger groups. It is rare to find anything but a blue among the soldiers and sailors, while among the actors, preachers and orators the dark eye is predominant, although for the population as a whole it is far scarcer than the light. The facts are suggestive, and it is not impossible that research may reveal an intimate connection between peculiarities of pigmentation and of mind.

Weather "Kiosks" at Home and Abroad

Meteorology for the "Man in the Street"

By C. Fitzhugh Talman

THE conservative behavior of Weather Bureau thermometers during the heated term has always been viewed with a certain degree of dissatisfaction by the non-scientific portion of the American public. After a particularly torrid day in an environment of brick and mortar, asphalt and steaming humanity, the wilted citizen, whose sensations have registered a temperature of 100 or more, feels aggrieved at a newspaper weather report recording an official maximum of 85. His only consolation was, until recently, the thermometer at the corner drug-store. This imposing-looking instrument usually soared nearly or quite high enough to confirm his personal estimate of the day's weather; especially if it happened to be hung in such a position as to bask in unobstructed sunshine during a part of the day. Some of these drug-store thermometers are fearfully and wonderfully made. As adjuncts of a quasi-scientific branch of trade they enjoy a certain prestige—along with the charts, also affected by drug-stores, in which the professional long-range weather prophet outlines the meteorological conditions for a month in advance on the basis of the moon's phases, the configuration of the planets, or the maxima and minima of sunspots.

At meteorological observatories the instruments are exposed in such a manner as to register, as nearly as the general surroundings will admit, the natural rather than the artificial weather. If, as in the case of most stations of the national Weather Bureau, the location happens to be the heart of a city or town, the ideal, not wholly attainable, is to record the conditions that would prevail if the buildings and pavements were not there. The abnormal weather of a city street is of no importance in gaging the weather of the country at large, either with a view to compiling climatic statistics or to providing information of current conditions for the use of the scientific forecaster. On the other hand, the demand of the "man in the street" for an accurate record of the conditions prevailing in his own little sphere is natural and legitimate; and the official weather service has recently responded thereto by establishing "kiosks."

Fig. 1.—German weather kiosks in the making.

The first Weather Bureau kiosks were erected in the year 1908, and they have now become familiar landmarks in most of our largest towns. The name "kiosk" officially applied to them is convenient, rather than appropriate. Their architecture is severely classical, and therefore as remote as possible from that of the oriental structures to which this name properly belongs.

Meteorological instruments installed in little pavilions on the public streets are familiar to every one who has traveled in continental Europe. In German-speaking countries these structures are called *Wettersäulen* ("weather-columns"), as they have a somewhat columnar form. In French they appear to have no generic name, but the writer is aware of one case in France—viz., at Le Mans—in which an installation of this general character has been called a "kiosque météorologique" for the past twenty-five years, although its appearance is not in the least oriental. No English name for these structures existed—probably because the thing itself was unknown in English-speaking countries—until the Weather Bureau decided to install such arrangements in this country. The catalogues of several foreign instrument-makers were examined with a view to finding the most suitable form of construction. Here the name "kiosk" was encountered as applied to one of these edifices that happened to have some semblance of oriental architecture. *Faute de mieux* this name was adopted by the bureau, although an entirely different style of construction was decided upon.

The external appearance of the Weather Bureau kiosk, which was designed in America, is shown in Fig. 2. The structure, which is of cast iron, painted a light color, is square, and the instruments are installed on the north side, so as to be sheltered as much as possible from the direct sunshine. The other three sides are used for posting weather maps and bulletins and other literature of general interest pertaining to the weather and climate of the locality. The location chosen is the busy center of a town; either a public park or the pavement of a principal street.

Air is freely admitted through gratings at the top and base to the roomy interior, and into this central space project the bulbs of the thermometers and the other actuating parts of the instruments, which are thus screened from the radiation of surrounding objects. The set includes a hair-hygrometer, with a scale of percentages of relative humidity; a plain mercurial thermometer of large size, graduated on the stem in conspicuous figures; self-registering maximum and minimum thermometers, the indexes of which are set by a magnet; a tipping-bucket rain-gage, the receiver of which is placed on the roof of the kiosk, while the dial, recording hundredths of an inch of rainfall, is exposed to view in the north panel; and a thermograph, making a continuous record of the temperature on a band of paper providing for a two weeks' registration. Printed labels briefly describing the several instruments render their use clear to the non-scientific public. The instruments are kept in order, the record-sheets changed when necessary, the

(*Continued on page 485.*)

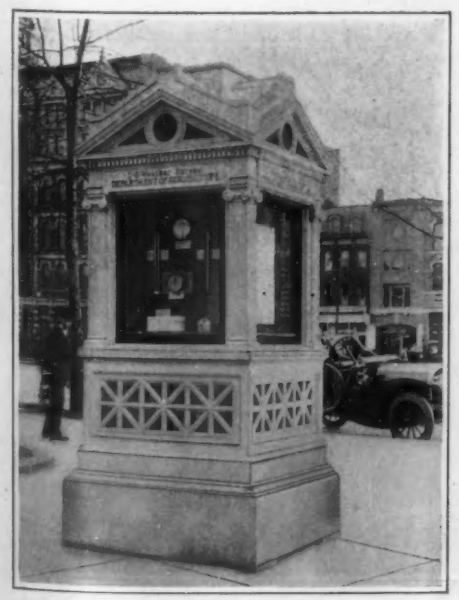


Fig. 2.—Weather Bureau kiosk.

A miniature meteorological observatory for the "man in the street."

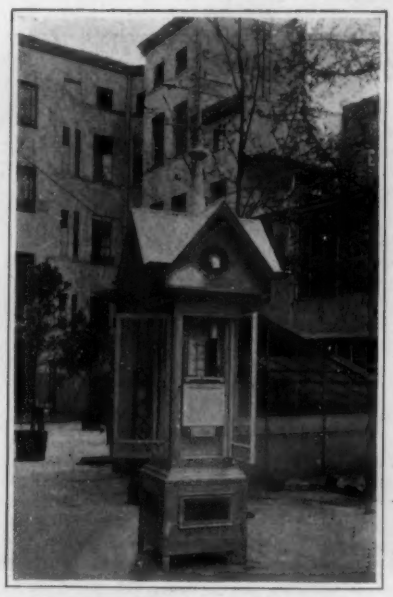


Fig. 3.—A well-constructed German kiosk.

Steady ventilation is provided by a revolving fan.

Photo. by Dr. C. Kassner.

Fig. 4.—"Uraniasäulen" in Berlin.

A Landsman's Log Aboard the Battleship "North Dakota"—IV.

By J. Bernard Walker.

This landsman's Log is written by the Editor of the SCIENTIFIC AMERICAN *as a preliminary to a magazine Naval Number to appear December 9th, which will be comparable in its size and completeness with the Naval Number issued during the Spanish War. In one respect it will be unique, for it will contain a signed message from President Taft, and will be written entirely by prominent officers of the Navy, each a specialist in the particular field that he covers. The leading article, moreover, will be from the pen of the Hon. George von L. Meyer, the Secretary of the Navy. The illustrations will consist of special photographs taken during the recent maneuvers and target practice of the Atlantic Fleet on the Southern Drill Grounds.*

THE landsman's log will fail of its purpose if it leaves an impression that target and battle practice with guns big and small constituted the whole of the activities of the Atlantic fleet on the Southern Drill Grounds. Nor must it be supposed that the gunnery consisted exclusively of firing by individual ships against individual targets. Every probable variation of war conditions was reproduced. I have a vivid recollection of the particular day when a division of four ships left the fleet, steamed in column until they were hull down, then turned, simultaneously, four points to starboard, and, moving at high speed in *echelon*, or diagonal, formation, delivered their broadsides upon a single target 9,000 to 12,000 yards distant. This maneuver, seen, as I saw it, on a glorious September afternoon, was a most stirring and picturesque naval spectacle—with fifty square miles of the sapphire-blue ocean for a stage and ten thousand men on a three-mile line of battleships for audience. Two or three points off the starboard bow of the "North Dakota," and some four miles distant, was the target, which was being towed at ten knots on the same course that we were following. Abreast of us and five hundred yards to port was the "New Hampshire," flagship of the Second Division, and, ship beyond ship, I could see the other eleven battleships steaming abreast, each like the "North Dakota," crowded on its bridges and forecastle deck with eager spectators of the attack. The firing division, six miles distant from the target, was some seven miles off the port bow of the farther end of our line. And so, from the observing fleet, we watched the four ships maneuver, now firing at the extreme bearing, for the whole broadside, forward, then turning to bring the batteries to the extreme bearing aft—and throughout it all, at the target, there soared majestically skyward those snow-white columns of water that told of the accuracy or otherwise of the shooting.

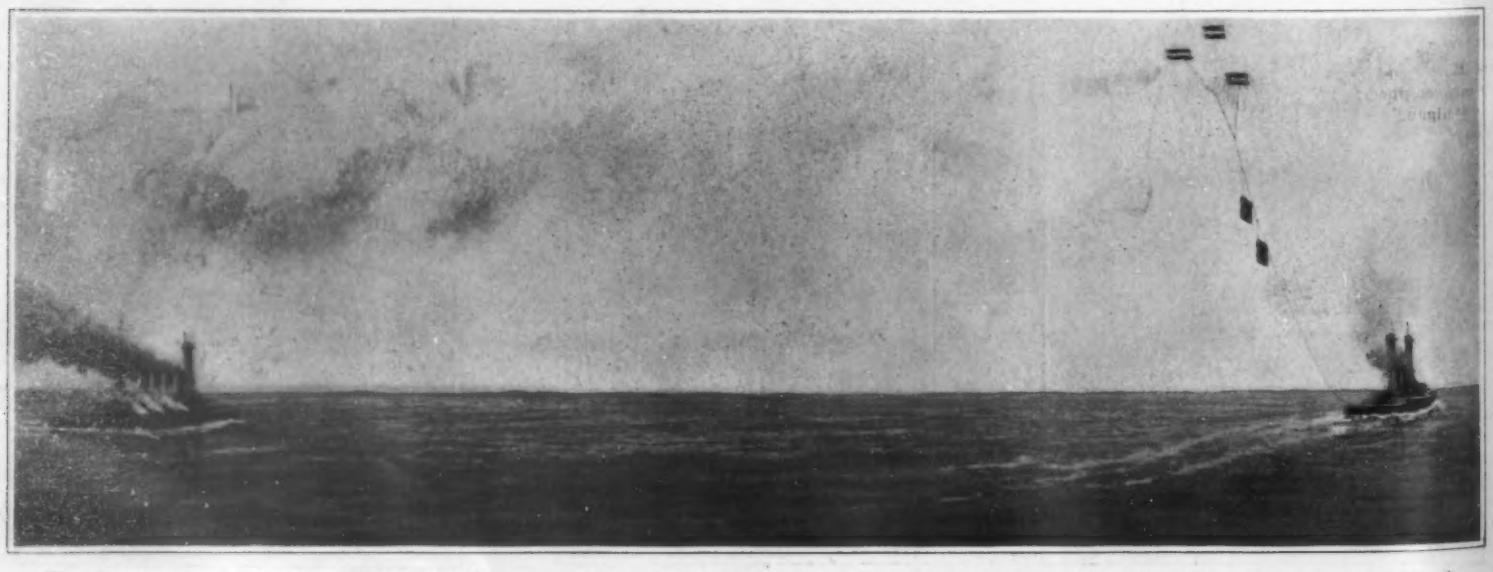
On other days individual ships would attack two widely separated targets at once—and again, ships would be sent out at night to try their 12-inch batteries upon targets that were 9,000 yards distant; while throughout all these operations the corps of wireless operators were working out special problems relating to their own special work, and particularly with respect to "interference."

"Aerial gun practice, however, is not confined to one-pounders and three-pounders. The Springfield rifle, whose bullet, at 45 degrees elevation of the gun, reaches a height of 6,800 feet, is such an effective piece that it will afford no inconsiderable defense against any aeroplane that might attempt to execute feats of bomb-dropping."

Every era of naval history has been fruitful, in varying degrees, in novel inventions and improvements and the many new problems which they have inevitably introduced. High explosives, electrically-operated mines, smokeless powder, the rapid-fire, high-velocity gun, the automobile torpedo, the torpedo boat, the destroyer, and the submarine have each in turn exercised their powerful influence upon the design and maneuvering of ships. To-day there has appeared a new engine of warfare, more puzzling than any of its predecessors, because, unlike them, its operations are not confined to the sea, but have invaded an entirely new element—the air.

Although the attitude of the Navy Department toward the so-called "aeroplane warfare" is conservative, it is by no means reactionary. While it is realized that much of the speculation as to the offensive capabilities of the aeroplane is premature and not justified by the present state of its development, naval men concur in the belief that, when a suitable type of machine has been evolved, the aeroplane will play an important part in the strategy of the future. This conviction has been deepened as the result of the experiments carried out by Ely and Curtiss in the effort to produce a machine suitable for naval scouting. The Curtiss "Triad," as it has been called, has shown that it can start and alight from a calm sea, and the work of this remarkable machine, following the feat of the late lamented Ely in alighting on the deck of a warship and starting therefrom, which has been repeated on other occasions, has carried the aeroplane scout a long step forward toward the stage—still a long way distant—when it can be regarded as a perfectly reliable medium for naval scouting. The exigencies of naval warfare demand that the aerial scout shall be capable of starting on its mission and gathering and transmitting its observations *in any weather*. With the present form of pontoons this is impossible; and it is difficult to imagine any form of sustaining device that would carry an aeroplane over the waves of a rough sea at the speed which is necessary for flight. It is possible that the solution of the difficulty will be found in the construction of special aeroplane tenders—high-speed vessels, with long, unobstructed reaches of deck, suitable as starting and landing places for the machines. Such vessels, if they were provided with large rudder area and designed for unusually quick maneuvering and rapid changes of speed, should be accessible for the safe return and landing of aeroplanes, even in considerable stress of weather.

But to return to our log, which, if it is to be true to its name, must contain a record, not of theories and



"Then the four-funneled cruiser 'North Carolina' drew up abreast of the targets and opened fire with a ranging shot, which missed. The second shot struck the piece of scantling which was fastened across the top of the target, cutting it in two and allowing the cloth to droop. The effect on the firing was instantaneous; for the range being now known, the gunners put shot after shot through the targets."

opinions, but of the actual work of the Atlantic fleet on the Southern Drill Grounds, as seen by civilian eyes, and of the impressions which it has left upon the civilian mind.

One of the most instructive and novel of the many visits paid to other ships of the fleet was an early morning trip to the "Michigan" for the purpose of witnessing aerial target practice. On mounting the gangway we found that the quarter deck had been turned into a veritable kite factory. Yards of red bunting, reels of wire, and a plentiful supply of light pine scantling was in the process of being built up into a number of box kites and several square targets measuring each about twelve by fifteen feet.

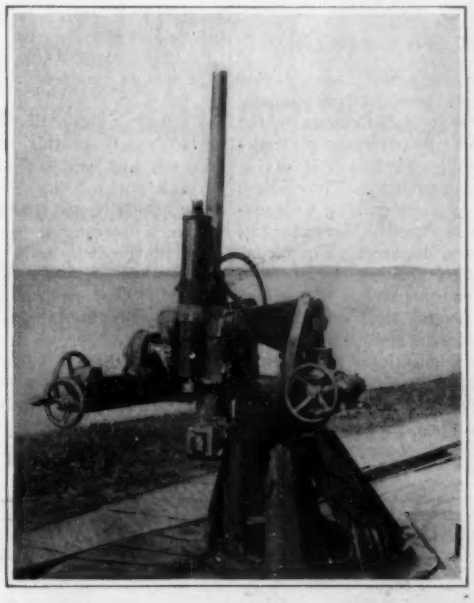
Now the handiness of the sailorman is proverbial; but I never knew till I got aboard the "Michigan" that he was an expert kite builder, and since I am perfectly certain that the building of box kites is not to be found in the curriculum at Annapolis, I may be pardoned my surprise and appreciation at seeing a stalwart lieutenant, armed with hammer, pliers, and a bag of wire nails, knocking a box kite together with as much facility as he would handle a sextant or a range finder, plot his ship's course, or bring a 20,000-ton battleship to her moorings.

The box kites completed, they were flown in a group of three from the stern of the "Michigan;" and after much hauling and slacking, and, or shall we say "backing and filling," were coaxed out of the bewildering cross currents of air, which formed the aerial wake of the ship, into the light and steady breeze which was blowing. The end of the cotton rope to which the kites were attached was made fast to a steel wire, which led through a haul-down block up to an extemporized winding drum, at the head of the port gangway to the boat deck. As the wire was paid out, the targets were attached to it in the position shown in our engraving, and when they had been lifted to a height of some 300 feet above the water (the limit of the lifting power of the kites in the light air which was blowing) they were ready for the firing.

Two ships had been delegated to the work of destroying the enemy; and as soon as the targets were ready one of the "Connecticut" class of battleships steamed rapidly out from the fleet until she was abreast of the targets and about 2,000 yards distant therefrom. She opened fire with her starboard battery of 3-inch, 14-pounders; fired some two or three dozen rounds; and then steamed in at full speed to take a closer look at the targets and see how often she had winged the enemy. Not a single shot had found the mark! Then the four-funneled cruiser "North Carolina" drew up abreast of the target and opened fire with a ranging shot which missed. The second shot struck the piece of scantling which was fastened across the top of the target, cutting it in two and allowing the cloth to droop in the center. The effect on the firing was instantaneous; for, the range being now known, the gunners put shot after shot through the squares, making a total of about a dozen hits. The different results accomplished by the two ships showed clearly the need for some form of tracer, such as I described in the last section of the log, dealing with night firing, to show the the course of the shells through the air and enable the sight-setter to make the proper corrections on the sight bars.

During the progress of the firing, the ordnance engineer of the "Michigan," who had charge of the kite flying, drew my attention to a phenomenon, which he suggested would form an interesting subject of speculation for the readers of the SCIENTIFIC AMERICAN. He asked me to note that after a 3-inch gun was fired, two distinct reports of the discharge were noticeable—one a sharp characteristic snap, which seemed to come from the locality of the target, and the other a more muffled report which reached the ship a few seconds later. The sharper report, by my timing, reached the "Michigan" in about 2½ seconds' time; the second report in about 5½ seconds' time. Now the velocity of the shell when it leaves the muzzle is about 2,800 feet per second; the velocity of sound is about 1,140 feet per second. The distance from the gun to the "Michigan" and the target (which was about 300 yards astern of the "Michigan") was about 6,000 feet, so that the sharp report traveled to the ship at the velocity of the shell and the duller, muffled report at the velocity of sound.

Now here is a pretty little problem in acoustics which we present for consideration. How came it that the first report of the gun reached the ear in about half the time that it should have taken, by all



"The ordinary gun mount on board ship allows an elevation not much above 15 degrees. For successful defense against aeroplanes, a higher elevation is necessary."

the laws of acoustics, in making the journey? Some one on the ship suggested that the first report was due to the noise of the shell as it passed the ship. But the "scream" of a shell is continuous, rising to its maximum intensity as it passes the listener, and dying away as the distance increases. Another suggestion was that a part of the sharp sound wave of explosion traveled in the attenuated air immediately behind the shell, being, in fact, "paced" by the shell, and that this portion of the air wave was sufficient to produce the loud, snappy effect above referred to.

The ordinary gun mount on board ship allows of an elevation not much above 15 degrees. For successful defense against aeroplanes, a higher elevation is necessary, and an experimental one-pounder is now being developed by the Bureau of Ordnance which, at an elevation of 45 degrees, will throw its shell to a height of 9,000 feet and a maximum range of 6,100 yards. With 85 degrees of elevation the shell will reach a maximum height of 18,000 feet.

Aerial gun practice, however, is not confined to one-pounders and three-pounders. The Springfield rifle, whose bullet reaches a maximum height of 6,800 feet, is such an effective piece that it will afford no inconsiderable defence against any aeroplane that might attempt to execute those feats of "bomb dropping" which are so popular a subject in the pages of the magazines and the Sunday papers. This rifle fires a 0.30 bullet with a muzzle velocity of 2,700 feet per second. Held at an angle of elevation of 45 degrees, the bullet will reach a maximum height of 6,800 feet and travel to a maximum range of 5,500 yards.

(To be continued.)

"An experimental one-pounder is now being developed by the Bureau of Ordnance, which at an elevation of 45 degrees will throw its shell to a height of 9,000 feet; and with 85 degrees of elevation will reach a maximum height of 18,000 feet."

The Demand for Young Men in Electrical Engineering

By Dugald C. Jackson, of the Massachusetts Institute of Technology

ANY branch of engineering is an exacting mistress for the man who makes it his profession; and this is particularly true of electrical engineering, which demands from its followers an unusual breadth and variety of industrial knowledge because it enters into the processes of almost all of the great industries found in the nation. The scope of an electrical engineer's work may be indicated by many striking examples. Both of the world's means of quick intercommunication, the telegraph and telephone, use electrical processes, and those of the telephone are so complex that they demand in their management a high class of engineering skill. City, suburban and interurban traction systems have fallen almost entirely under the monopoly of the electric motor, and railway freight traction over mountain divisions of steam railroads seems likely to soon come under the same influence. The electrical transmission and distribution of power have put artificial illumination of streets and houses on a plane never previously reached or imagined, and their processes are being constantly improved and extended. Even in the manufacturing industries, the use of electrical power has served to increase the output and decrease the cost of product in many different kinds of works, and the utilization of electric power is therefore greatly enlarging.

It is obvious that adequate training for a profession that brings its followers into contact with so many of the activities and nearly all of the industries of the nation must consist essentially of those principles of science and humanity which are fundamental to all, and an electrical engineering course must therefore be made strong in chemistry, physics, mathematics and applied mechanics, and those subjects must be associated with the study of machinery, stationary structures, hydraulics and steam engineering. Also along with these, extended study is required of the fundamental nature of the flow of electric current, the phenomena of electromagnetism, and the ways in which these may be usefully applied in the world's activities and particularly in industrial affairs. Very little time can be given to those features of engineering practice which are of a nature which can be mastered with comparative readiness by observation after graduation. An appropriate electrical engineering course sufficiently occupies the time available for undergraduate study if it is confined to cultivating a knowledge of scientific and eco-

(Continued on page 486)

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

A New Process for the Felling of Trees

By Dr. Alfred Gradenwitz

THE attempts from time to time to cut trees with a wire heated by electricity so far have not given satisfactory results.

Now a Berlin inventor, Mr. Hugo Gantke, has recently succeeded in designing an extremely simple device for the mechanical felling of trees. The trunks are cut by the friction of an ordinary steel wire about one millimeter in diameter (No. 18 B & S gage) which, as shown by practical tests, is able to saw through a tree about 20 inches in diameter, in six minutes.

The steel-wire, driven by an electric motor, is heated so intensely by friction on the wood as to burn a thin carbonized kerf, which is both smoother and cleaner than the cut of a saw. The charcoal layer adhering to the trunk is extremely thin and allows the structure and any disease of the wood to be distinctly recognized. It enables the tree to be marked with chalk, and at the same time serves to preserve any trunks that may be left temporarily in the woods.

Unlike other saws, this felling machine will work freely even on the thickest trees, without requiring any wedges to be inserted into the cut; for instead of any shavings we have only smoke and steam and hence there is no danger of the cut's becoming obstructed. The trees may be cut close to the ground, or even below the ground as far down as the beginning of the roots will permit. In the latter case the stump may be safely left in the soil. The electric motor that drives the steel wire is placed where it is not in danger of being struck when the tree falls.

While mechanical operation is in itself much more rapid than hand-labor, a further acceleration is derived from the absence of any intervals of rest between two cuts. As a new piece of steel wire costing but a few cents is taken for each cut, there is no loss of time due to the sharpening of saws, etc. Only one man is required to operate the machine as against two men working with hand saws, and the larger the tree the higher is the relative cutting speed.

When electricity is not immediately available, it can be generated by any existing steam or water plant. It may frequently be found advantageous to use a portable power-plant consisting of a 10 horse-power gasoline motor and dynamo which may be installed temporarily in a central location. A flexible cable may connect the dynamo with the felling machine which can be readily transported and operated by one man.

An important advantage of the new method arises from the absence of any waste, the cut only two millimeters (0.079 inch) in thickness being perfectly smooth and level, whereas axes and saws are bound to injure the trees to a considerable extent.

Review of the Report of the Commissioner of Patents

THE Commissioner of Patents, Hon. Edward B. Moore, in his report to the Secretary of the Interior, for the fiscal year ending June 30th, 1911, makes some very vigorous recommendations regarding needed legislation for the United States Patent Office, besides touching upon the work already accomplished along the line of improvement in that branch of the service.

The Commissioner reports the work of the Office to be in a very satisfactory condition and practically up-to-date in all its branches. He states that while Congress has been fairly liberal in its appropriations for the increase of salaries and providing new positions, thereby enabling the institution of many needed reforms, there is still a certain percentage of separations from the Office of trained examiners who accept offers of larger alaries from outside firms and corporations. The Commissioner, however, does not ask for an increase in the salaries of the examining corps at this time.

Gains in Efficiency and Economy.

The Commissioner reports that a saving of from five to six thousand dollars annually has been the result of the change in the manner of printing certificates of trade-mark registration, and that this saving will be continuous annually. The changes in the rules of practice relating to trade-marks, which were effective November 1st, 1911 are expected to accomplish a considerable saving of time to examiners in searching this enormous class of applications. At the present time it is required that the examiners search through some 20,000 pending applications, which are in the various stages of prosecution. It is proposed to have the same rules apply to applications for the registration of trade-marks as now apply to applications for patents; that is, they must be amended within one year or the application becomes abandoned, the applicants still having the right to file new applications if desired.

Portable device for mechanical felling of trees.

Plans are under way to accomplish an economy in the method of publishing and issuing the *Official Gazette*, to the extent of saving between eighty and ninety thousand dollars a year. This will, it is believed, increase the efficiency of the *Gazette* as a work of reference, reducing its bulkiness and making it more compact and easily handled.

Legislation.

The Commissioner renews his recommendations with regard to the urgent legislative needs of his Office. Paramount is the bill recently reintroduced by Mr. Oldfield, the Chairman of the House Committee on Patents, which provides for the elimination of one of the appeals within the Patent Office. This measure contemplates the consolidation of the board of examiners-in-chief with the Commissioner and the two assistant commissioners, forming one judicial tribunal to hear appeals taken from the primary examiner. It is argued by the Commissioner that this will accomplish an immense saving in time for the passage of appeals through the Patent Office and will also be a saving in money to the inventor, who will thus be relieved of the necessity for paying for a double appeal in the Patent Office in carrying his cases through to the Court of Appeals of the District of Columbia, the court of last resort in such cases.

The policy of the Government at the present time is to avoid all unnecessary duplication of work and relieve the officers of the various branches of much work that has become burdensome to all concerned, as well as wholly unnecessary. Mr. Moore states that it is practically the unanimous opinion of inventors and manufacturers throughout the country that one appeal should be eliminated in the Patent Office in order to save the great cost and loss of time now involved in obtaining a final adjudication and consequent grant of patent.

He further states that he has been supported widely in this effort to facilitate business, and states that this is an important part of the plan to expedite business and to grant patents to inventors within a reasonable time, which they have demanded, and to which they are entitled. Bills embracing the substance of this recommendation were introduced by Senator Smoot and were passed by the Senate. No action, however, was taken upon these bills in the House.

Other measures of importance are strongly advocated by the Commissioner. One provides for the filing with an application for patent, in addition to the drawing, two photographic copies of such drawing. This imposes upon every applicant for patent an additional statutory requirement, to wit, to file with each application of which a signed and attested drawing forms part, two photographic copies of such signed and attested drawing. The purposes of this requirement are to guard against and enable the detection of unauthorized changes in the original drawing or abstraction of such drawing and substitution of another; and to lessen the danger of serious mistakes on the part of the Office in failing to detect interferences between co-pending applications for the same invention.

An important measure is that which requires that an application for patent shall be prosecuted within six months after any action by the Patent Office. The bill is aimed to cause the more speedy prosecution of applications and should have the effect of preventing the holding of applications within the Office for a great length of time for the purpose of extending the patent period.

The Commissioner also urges the passage of the bill which authorizes the issuance of certificates of correction in cases where the patent as printed does not conform to the record.

In connection with the recommendation for elimination of one of the appeals in the Patent Office, the Commissioner furnishes a table showing the extent of the heavy appeal docket for the fiscal year, which epitomized, shows the number of interferences declared to be 1,537; appeals to the examiners-in-chief, 1,102; appeals and petitions to the Commissioner, 2,912.

The Heany Cases.

The Commissioner reports the termination within the Office of the investigation arising out of the original criminal trial of Heany, Barton and Everding, for forgery and violations of Sections 5403 and 5440 of the Revised Statutes. The criminal trial, which resulted in the conviction of Barton and Everding and the acquittal of Heany, was followed by the Commissioner's order against Heany to show cause why certain interferences in which his applications were involved, should not be dissolved and his applications included therein and other applications also tainted with fraud should not be stricken from the files and treated as a nullity. The hearings resulting from this order were before the First Assistant Commissioner, owing to Mr. Moore's being occupied with other important duties connected with the conference at Buenos Aires and the conference at Washington. The hearings began in the summer of 1910 and lasted for several months.

The conclusions reached, ordering that the Heany applications be stricken from the files, as set forth in the First Assistant Commissioner's decision printed in the *Official Gazette* of October 24th, 1911, meet with the Commissioner's unqualified approval, and Mr. Moore also takes occasion to express his appreciation of the valuable assistance rendered by former Examiner-in-Chief L. H. Campbell, Mr. F. C. Skinner, at present Examiner-in-Chief, and by Mr. Eugene D. Sewall, Examiner of Classification, who acted as a Board in the original investigations preceding the criminal trial; and of the services rendered by Mr. Skinner and Jesse C. Adkins, Esq., at the trial, and by Mr. Adkins and Chief Law Examiner Webster S. Ruckman, during the investigations arising out of the order to show cause.

Mr. Moore states that the Department of the Interior and the Patent Office are to be congratulated at the very satisfactory termination of the criminal case and the Office investigations as well. He reiterates his statement made in a previous report and to the press that the Heany case is the only one of its kind that has ever occured in the Patent Office during the 117 years of its history.

The Patent Bar.

The Commissioner invites attention to the necessity for legislation which would result in the establishment of a patent bar. It is strongly urged that a law be enacted which will provide that before an individual shall be permitted to practice before the Patent Office, he be required to pass an examination as to his moral, legal and technical qualifications, and that a committee be appointed by the Commissioner of Patents composed of officials in the Patent Office and patent attorneys of well-known standing in the profession, who shall conduct the examination under the Commissioner's supervision, the report of such committee to be subject to his approval.

The Commissioner states that a redraft of a measure looking to this reform will with the Secretary's approval, be prepared and presented to Congress in a short time.

Scientific Library and Other Matters.

A complete reorganization of the Scientific Library is contemplated by the Commissioner, who states that a classification of the enormous amount of foreign publications, including patents and works of reference, and books of great value to attorneys and examiners in their search for anticipations in the arts, is an immediate necessity. The Commissioner is disirous of having the whole subject

thoroughly digested, so that it will be readily accessible and thereby do away with much expense and loss of time.

The Commissioner asks for an additional force to aid in this work, and also requests an increase in the force of translators.

International Conferences and Treaties.

The Fourth International Conference of American States held in Buenos Aires in 1910, and the Conference of Washington of the International Union for the Protection of Industrial Property, 1911, are both referred to by Mr. Moore as being productive of much good in the harmonizing of international relations with regard to patents, trade-marks and copyrights. The three conventions adopted at Buenos Aires were prepared by Mr. Moore and are strictly in the interest of the manufacturers, inventors and authors of the United States. These three conventions have all been approved by the United States Senate and are awaiting ratification by the twenty Latin American nations represented, several of whom, it is understood, have ratified them, and others still have them under consideration.

The conference at Washington to amend and consider the Paris Convention of 1883, was attended by delegates from forty nations, including nations adherent to the Paris Treaty and those specially invited to participate, but who had no voting powers. Important conventions affecting changes in both the patent and trade-mark laws were discussed at the conference, and the final convention was adopted and signed by the delegates subject to the ratification of their various governments. The language of the conference was French as provided by the Treaty of Paris.

Mr. Moore, who was chairman of the American delegation, states that it was the announced opinion of all the delegates present that it was the most successful conference of the Union ever held. He states that aside from the very desirable changes of the laws of nations relating to patents and trade-marks, there is another important underlying reason why these conferences are desirable. They bring together men familiar with the subjects to be discussed, who become well acquainted and talk over their differences not only in formal session, but in private conversation, while mingling socially.

During the conference the Commissioner received a cablegram announcing the passage by the German Reichstag of a law upholding the treaty between Germany and the United States, providing that patents of American inventors should not be revoked by the German government for failure to work or manufacture the same in Germany within four years, provided, however, the same is manufactured in the United States in the same period of time. Mr. Moore personally negotiated this treaty with Germany and in addition succeeded in accomplishing the revision of the laws of Norway, Sweden, and Switzerland, so that the manufacture of patented inventions in those countries by United States citizens is not longer required in order to sustain their patents. It is thought that several other countries will speedily follow this example.

Urgent Need for New Quarters for the Patent Office.

As a climax to his other very strong and well-considered recommendations, the Commissioner reiterates with renewed emphasis the very imminent need of new quarters for the United States Patent Office. He offers in his report two remedies for the over-crowded and wholly inadequate conditions that now exists. The first is a complete remodeling of the present building in accordance with plans which he has drawn up and which have been approved by the Supervising Architect of the Treasury and the Architect of the Capitol. The second is the construction of a new building on the site immediately north of the library of Congress, and which was contemplated by the Daniels bill, introduced in the 61st Congress.

The Commissioner urges many excellent reasons in support of his contention, not the least of which is the constant danger from destruction by fire which threatens the valuable archives of the Patent Office, and the loss of which would work irreparable damage to the commercial interests of this country. Considering the fact that there is a net surplus in the United States Treasury earned by the Patent Office and paid in by the inventors amounting to more than seven millions of dollars, the Commissioner believes it only fair that part, if not all, of this sum should be expended in the furnishing of larger and better quarters, with modern facilities for the force, which would then be in a position to accomplish the best possible results in the work for which the outside inventive public pays the total cost.

This is a matter in which the whole country is interested and it should be the avowed determination of every manufacturer, merchant and inventor in the United States to aid in every way possible, within his power, the building of a newer, greater and safer Patent Office.

Death of Examiner McKee

ROBERT M. McKEE, an assistant examiner in the United States Patent Office, died at his home in Washington on November 5th. Mr. McKee was the oldest examiner on the force, being in his eightieth year. He was a native of Hanover, Chautauqua County, New York, served in the Army of the Potomac during the civil War, and gained an enviable reputation as a teacher in the Washington public schools, being up to 1876 supervising principal of one of the prominent school districts. In 1885 he entered the Patent Office as an assistant examiner and for many years examined pneumatic and other door checks and hinges. While nearly eighty years of age, he did not seem an old man, having a bright, alert manner, a clear active intellect and the appearance of being ten years under his real age. He was able to perform his duties in a most satisfactory manner up to his last illness of nearly three months. He was genial, kindly, possessed the ability to make and keep friends, was skillful in his business, and able to do a man's work to the end and will be greatly missed by the many who had business in his special classes of invention.

Notes for Inventors

Electric Lamp as a Bed Warmer.—John Alden of Boise, Idaho, has patented (No. 1,004,956) a bed warmer which includes a metal casing covered with asbestos so that it will not burn the feet of the sleeper and having an opening through which the heat from an electric lamp in the casing can escape to heat the bed.

Imitation Air Voyage.—In a patent (No. 1,005,061) Robert Macfarlane Murie of Invercargill, New Zealand, provides an apparatus for producing the illusion of traveling in an airship. The apparatus includes a dark room, a lift to support the passengers which is caused to move up, down and sideways in the dark room. A screen is arranged in front of the passengers and moving pictures are projected on the screen, the moving picture device and the lift being connected together so they will move in unison to heighten the illusion.

Combined Aeroplane and Parachute.—William A. Crawford-Frost of Baltimore, Md., has patented (No. 1,005,609) an airship improvement in which a supporting plane is provided with openings and a parachute folds upon the top of the plane to close the openings and opens upwardly to extended position to operate as a parachute when desired.

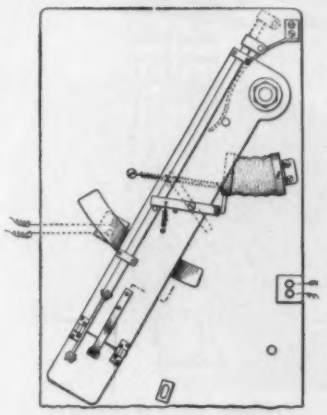
A Concrete Floor With Glass Blocks.—Henri L. J. Crochet, assignor, of Paris, France, has patented (No. 1,005,611) a readily removable paving block for reinforced concrete floors, which is of glass, and has an external thread and is formed in its inner end with a light recess which is adapted to receive a spanner so that the block can be conveniently turned when it is desired to remove it.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

AUTOMATIC SWITCH.—JOHN L. POLE, Menands, Albany Co., N. Y. This automatic switch is for use in controlling electric currents, the switch in one of its movements being automatic, and also sluggish in its action. More particularly stated a switch is provided having a lever movable by hand in one direction and movable in the opposite direction by the action of a spring and against the cushioning pressure of a dash pot for the purpose of retarding the movement or rendering it sluggish, the idea being that when the switch lever is in one of its extreme positions it closes one electric circuit and a few moments afterward opens that circuit and automatically closes another. A plan view is shown herewith complete, the lever occupying its extreme position to the left and closing one of the circuits.

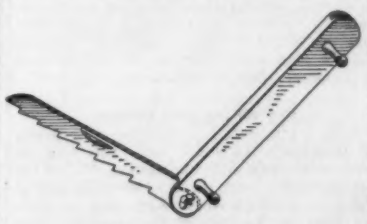


AUTOMATIC SWITCH.

COLLAPSIBLE HANDLE CAN.—E. G. CANEPA, Portico Vittorio Emanuele, 4A, Genoa, Italy. This invention relates to metallic vessels and cans, the object being to produce an article at cheap price and easily carried by minimizing the space occupied in packing. These results are obtained by forming the mouthpiece for pouring the liquid contained in the vessel in the shell of the same, and further by providing a yielding handle which, in packing, can be brought in contact with the body of the can, thus avoiding any projecting part.

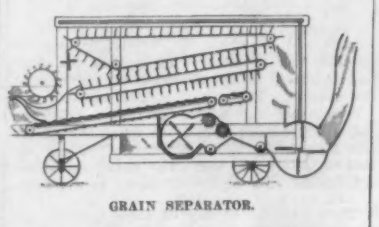
Of Interest to Farmers.

FOLDING HAY KNIFE.—LUTHER L. CARR, Chalmers, Ind. The object in this improvement is to provide a novel construction of knife in which the blade can be conveniently folded into the handle so that when the knife is not in actual use, the blade will be housed within and protected by the handle, the handle and the blade being so formed that the former operates as a stop to limit the opening movement of the blade at the proper point and the handle being provided with hand-holds for convenience in manipulating the knife, means being provided for holding the blade to the handle both in the opened and closed portions of the blade. The accompanying view shows the knife with the blade in position for use.



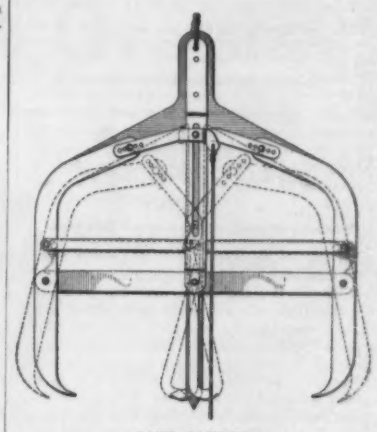
FOLDING HAY KNIFE.

GRAIN SEPARATOR.—CHARLES G. BRANCH, 1019 North Mosley Street, Wichita, Kan. The purpose of the invention is to provide a device wherein all vibrating parts are eliminated, the grain being separated by carriers and the like, thus dispensing with noise, and eliminating the great strain on the mechanism of vibrating or reciprocating parts. A vertical longitudinal section is shown in the engraving. The toothed wheels are very necessary since they thoroughly beat and shake up the straw so that the grain drops out of the straw. Screens and wheels work to secure cleaning action, thoroughly separating grain and straw, so that only a small portion of grain is passed out through the stack.



GRAIN SEPARATOR.

BALE CARRIER.—EDWARD H. BOEHME, R. F. D. No. 2, Rankin, Ill. A front presentation of a bale carrier patented by Mr. Boehme illustrates this article, and the inventor's object is to provide a simple, inexpensive and easily operated fork especially designed and adapted for lifting material, such as hay, straw, and the like, in bales, which will firmly hold, during elevation and transportation, a plurality of bales, and which may be easily and quickly engaged with and released from the bales. The levers cannot be disengaged until the trip rope is pulled.



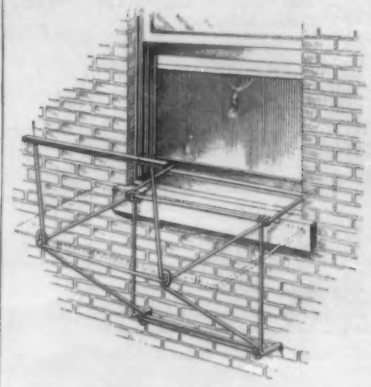
BALE CARRIER.

Of General Interest.

HOD STAND.—SAMUEL H. MOORE, Phoenix, Ariz. This invention is an improvement in hod stands for use in holding hods for carrying brick or mortar, and the invention has for an object the provision of a novel construction of folding hod stand which can be adjusted to suit any size of mortar or brick hod and hold such hod when applied to the stand at any desired angle. In practice the stand may be made of wrought iron of suitable size and dimensions to give the necessary strength for supporting the hod and the device will be found useful for the purpose for which it is designed. The engraving shows a perspective view of the stand as in use, the hod being in position.

HOD STAND.

FOLDING SCAFFOLD.—E. ZAHN, Rhodesia Park, Norwalk, Conn. Mr. Zahn's invention relates to folding scaffolds for general use, his more particular purpose being to provide a simple, strong and efficient scaffold suitable upon the exterior faces of building walls and



FOLDING SCAFFOLD.

adapted to be let out and drawn through windows or the like. In order to erect the scaffold as shown in the accompanying illustration, the device is let out through the window, so that the window bar lodges against the inner face of the wall upon opposite sides of the window. To take the platform within the building, the floor consisting of boards (shown in dotted lines) is first removed and taken inside. The bar at the top is next grasped and pulled over practically through the window.

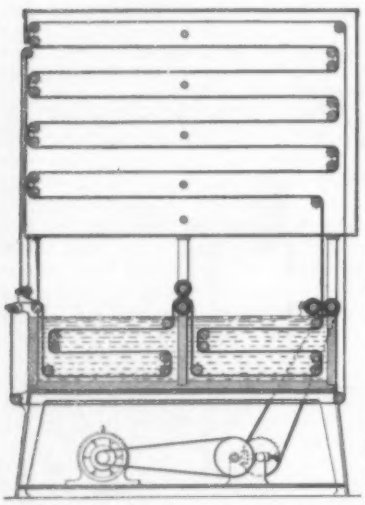
Household Utilities.

MEAT COOKER—A. REUBOLD, 1120 Fox Street, Bronx, New York, N. Y. This invention provides an airtight receptacle in which food may be placed, and means for closing this receptacle so that juices and volatile parts of the meat will be retained, thereby preserving the flavor, preventing shrinkage and increasing its value as an article of food, the use for which the device is best adapted being the cooking of bone hams and pork shoulders, so as to preserve their flavor, juices and aroma.

Machines and Mechanical Devices.

VALVE.—J. D. ROBERTSON, 219 South Seeley Street, Chicago, Ill. In this case the valve head is of thimble form and fits over and is secured to a cylindrical float filled with buoyant material, as cork, to float the valve in water. The valve is movably confined and guided in a cage and means provide to limit the drop of the valve from its seat. It is especially designed for tanks, to prevent overflow of water, without interfering with the circulation of air and steam, the valve obviously rising and being forced tight to its seat by the rise of the liquid level.

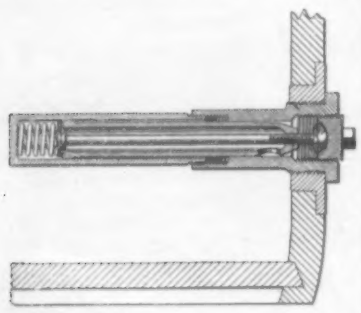
BLUE PRINT WASHING AND DRYING MACHINE.—OSCAR HOOPS, Grove Street and Chicago Avenue, Elmhurst, L. I., New York. A sectional elevation of this machine is represented in the engraving herewith. The inventor provides a machine having two endless belts, having sprocket openings at their sides



BLUE PRINT WASHING AND DRYING MACHINE.

which are disposed against each other, and which run over rollers with sprocket teeth journaled in a casing containing tanks, and a compartment for respectively washing and drying the blue prints. The prints are conveyed between the belts through the machine, and are introduced and removed at points outside the casing where the belts are spaced from each other.

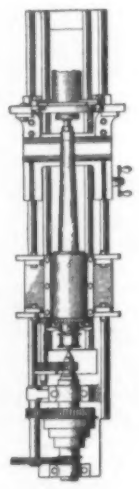
COMBINATION BUNG AND FAUCET.—EDWARD D. WILSON, Box 25, Strong, Kan. This invention has reference to faucets, and it has for its object the provision of a bung having contained therein a valve mechanism for use in controlling the flow of liquid through the receptacle, and through an opening in the side of which the bung is disposed, so that when the plug is removed from the bung the valve is in position for use. The accompanying illustration gives a view in sectional elevation showing the device attached



COMBINATION BUNG AND FAUCET.

to the side of a barrel. The bung is made in two sections, so that the valve member may be readily disposed in position.

CYLINDER GRINDING MACHINE.—EDMOND STONE and WILLIAM STONE, 3510 South Wood Street, Chicago, Ill. This invention relates to mechanism for grinding and dressing the interior surfaces of hollow cylindrical bodies, such as engine cylinders and the like. The invention is used in connection with an ordinary machine shop lathe, and the illustration shows a plan of the lathe having the attachment mounted thereon. It sometimes takes hours to properly set and center a cylinder to be bored out, but by the present arrangement it may be accomplished in a few minutes. An important feature is the orbital movement. This must always be positive and the grinding-wheel made to travel in the path of a true circle and doing the work accurately with all mechanical precision.



CYLINDER GRINDING MACHINE.

Railways and Their Accessories.

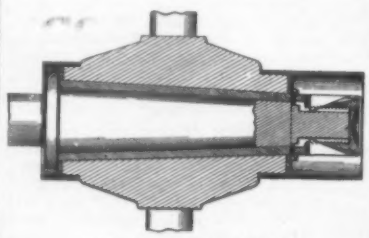
CROSS TIE.—WILLIAM E. JONES, Chase Mills, N. Y. The object here is to provide a durable cross tie intended to replace the ordinary wooden tie now generally used, which can be employed with railroad track rails and the like, with which ordinary rail-holding means such as spikes, chairs and braces now

CROSS TIE.

generally employed can be used, which tends to prevent spreading of the rails, by means of which one or the other of the rails can be raised or lowered as necessary, which can be employed on straight track sections as well as on curves, and the employment of which permits the tracks to be easily and expeditiously laid and repaired. The engraving herewith gives a plan view which shows the tie used to support a pair of track rails.

Pertaining to Vehicles.

HUB ATTACHING DEVICE.—JEFFERSON D. ROBERTSON, La Plata, Md. This improvement is in hub attaching devices for use on vehicle wheels and the like and has for an object to provide a novel construction by which the wear on the ends of the box fitted upon the spindle may be easily taken up and by which the nut may be adjusted to take up this wear and may be locked in any described adjustment upon the threaded tenon of the spindle and in which the locking devices for the nut may be released by moving the same longitudinally in the direction of the axis of the spindle. There is a locking bail for the hub securing nut, which bail has a cross bar extending radially across the outer end of the nut in position to be grasped in pulling the bail to unlock the nut. The engraving shows a sectional view of the device as in use.



HUB ATTACHING DEVICE.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

HISTORICAL ATLAS. By William Shepherd. New York: Henry Holt & Co., 1911. 8vo.; 216 maps, 94 pages of text. Price, $2.50.

This is one of the most valuable atlases that has come to the reviewer's table in a very long time. In the first place, the data for the maps have been compiled in a most scholarly way by an expert, also with the advice and assistance of a splendid list of geographers and historians. In the second place, the maps, which, by the way, were printed in Germany, are magnificent examples of the cartographer's art. The combination of colors which are apt to be so very crude in atlases of American origin are toned down and admirably contrasted. It is very difficult to call attention to any salient feature of this book, as it is of uniform excellence. Among the very interesting maps, however, are those showing the various Routes of the Crusaders; the Ecclesiastical Maps of Europe; the very interesting map showing the routes of the Mediæval Commerce; the Seats of the Mediæval universities; the Mediæval Commerce of Asia; Plan of a Mediæval manor; the Age of Discovery; the Principal Seats of War in Europe in all Centuries; the Growth of Russia; Napoleon's Campaigns; the Unification of Germany; the Balkan Peninsula; the Commonwealth of Australia; the Partition of Africa; the Distribution of the Principal European Languages; the Colonies, Dependencies, and Trade Routes; Localities in Western Europe Connected with American History; Localities in England Connected with American History; the Indians in the United States; the New England Colonies; Campaigns in the American Revolution; Territorial Expansion of the United States; Organization of Territories; Slavery and Emancipation in the United States; Westward Development of the United States, and lastly, the Panama Canal. It would almost be ungracious to offer any criticism of this splendid work, but it is suggested that the 208th map, showing the seat of the Civil War, might have been made a two-page map to greater advantage, as a map of this kind is very much needed.

TO MOTHER. By Marjorie Benton Cooke. Chicago: Forbes & Co., 1911. Price, 50 cents.

It is seldom that one can whole-heartedly indorse present-day poetry such as this. The mother-theme, too, must be well handled not to be made ridiculous by distortion of values on the one hand, or by a cheap verbosity unsuited to meter on the other. This being so, we take the greater pleasure in acknowledging the sweet dignity and the repressed yet strong appeal of the author's lines. Even in ending her sonnets with the rhyming couplet—a form now frowned upon—we believe she has selected the mode most effective with such a theme and treatment. For all mothers, and for all children of mothers, this little gift book must strike a true and uplifting chord.

THE HINDU-ARABIC NUMERALS. By David Eugene Smith and Louis Charles Karpinski. Boston: Ginn & Co., 1911. 8vo.; 160 pp. Price, $1.25.

Of all the numerous published monographs on our system of numerals, none can be said to present a complete history of their origin, adoption, and adaptation. The libraries of Europe and America have been searched in pursuit of the information embodied in "The Hindu-Arabic Numerals," and all available evidence has been carefully weighed and passed upon. The result is a reliable and fairly comprehensive review of the subject, from what is known of the origin of the characters, the earlier use of the place value, and the introduction of the zero, to the development of the system by the Arabs and its spread over the face of Europe. When we consider that this system has been in general use for but four centuries, and when we realize the amazing clumsiness of the Roman characters which it displaced, we must approach its history with an enhanced respect and with an increased gratitude for what the system has done for our civilization.

TEXT-BOOK OF MECHANICS. By Louis A. Martin, Jr. Vol. III. Mechanics of Materials. New York: John Wiley & Sons, 1911. 12mo.; 229 pp. Price, $1.50 net.

The author gives us a text-book of mechanics, designed for colleges and technical schools, in four volumes. "Statics" and "Kinematics and Kinetics" have preceded this, while "Applied Mechanics" is in preparation. The aim of the series is such an arrangement and presentation of its subjects as will encourage the student to reason as well as to memorize—to prove for himself, instead of simply accepting statements and solutions. The various stresses and strains are classified and explained in this third volume, and diagrammatic sketches and notations lead naturally up to the appended exercises and examples. The answers to the interpolated problems are given together at the back of the book, and there are between forty and fifty review problems given with the object of refreshing the memory and fixing principles indelibly in the mind.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12565) L. G. asks: Kindly inform me if rocks, stones, and boulders grow as they lie and are in the earth. A. Rocks such as boulders do not increase in size as they lie upon the earth or buried in it. Layers of rocks have formed from their materials being pressed together under the ground by the weight of the earth above them in the long ages of the past.

(12566) A. G. asks: I am ashamed to ask you, but can you tell me the speed at which air at 60 degrees and 15 pounds would rush into a perfect vacuum? I cannot find the information in two encyclopedias nor two books on physics. A. You need not be ashamed to ask at what velocity air will rush into a vacuum, since no one can answer it. Air at 15 pounds pressure rushing into a place where there is no pressure will at that instant have an infinite velocity, the ratio of 15 to 0. From that instant the velocity will diminish until the pressure inside is equal to that outside, and the velocity will then become zero. Between these two velocities there will be all possible velocities. No single velocity can be given. The 60 degrees does not affect the result. If any text-book or encyclopedia gave a single velocity for this case, it would have to be marked "Interesting, if true."

(12567) C. A. P. asks: Please answer the following in your column for queries: Does the top of a wagon wheel travel faster than the bottom? Please give explanation. A. The top of a wagon wheel travels along the road with the same speed as the wagon to which it is attached, else it would come off the wagon and go into the ditch. All parts of the wheel also rotate around the axle with the same speed, else the wheel would break into pieces. Lastly, the motion of a wheel may be referred to the ground over which it moves. It will then be found to have a very curious motion. Mark a spot on the felloe with a chalk mark, so that you can see just where it goes with reference to the ground. As the wheel rolls along, the chalk mark coming down to the ground, is in contact with a point on the ground for an instant, and rises again till it is at the top of the wheel, and this it does every time the wheel moves as far as its own circumference. When the mark is half way down from the top it is in front of the hub, and when it is half way up again it is behind the hub. It has gone back the whole diameter of the wheel, just as it went up the whole diameter of the wheel. It moves down and up, forward and backward, as it rolls around its hub, and moves along with the wagon as a whole. The fact is, if the wheel does not slip, the mark stands still on the ground while it is in contact with the ground. The fact also is that the mark at the top of the wheel moves forward twice as fast as the hub moves. The mark moves backward, as seen from the wagon, from the time it is on the level of the hub moving down till it is on the level of the hub going up, and forward during the rest of its rotation. If you would see the actual path of a point in the circumference of a rolling wheel, take a circular piece of board and fasten a crayon into a hole at its edge; then roll the board along the chalk trough on a school blackboard in such a way that the crayon may trace its path on the blackboard. You will have the curve described by the point of the wheel along a vertical surface, just as the wheel traced its curve in the air. This curve is called in mathematics a cycloid. You will doubtless find a picture of it in any large dictionary. This matter seems to make a great deal of discussion. We are obliged to print the explanation very frequently.

(12568) J. S. K. asks: I am curious to know why, if the secondary terminals of a transformer are open, there is no apparent flow of current in the primary windings. For instance, take a bell-ringing transformer designed to work on 110-volt alternating current at 60 cycles and to step the current down to 6 volts. If the secondary terminals were open we detected no current flowing through the primary, but when the secondary was closed our instrument showed a flow of current in the primary. If you can give me the reason for this in the columns of your paper I will be under obligations to you. A. When the secondary circuit of a static transformer is open it is perfectly idle, no current is flowing through it, and no inductance exists between the primary and the secondary. In this case the primary acts simply as a choke coil, and the inductance of the primary upon itself cuts the current in the primary down to a small value. In your little bell-ringing transformer it is too small for your instrument to detect.

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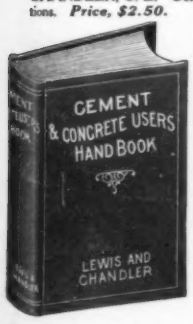

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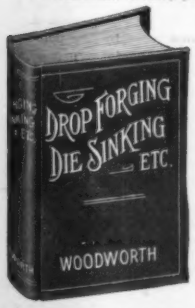

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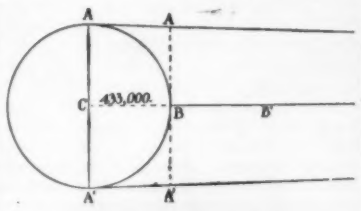
If the Sun Were Suddenly Extinguished

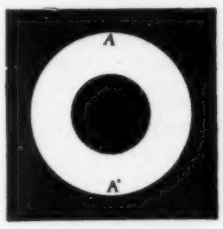
To the Editor of SCIENTIFIC AMERICAN:

Probably many readers of the SCIENTIFIC AMERICAN have wondered what phenomenon would appear were the sun to be annihilated instantly. Many, I suppose, thought that the light would be shut off immediately.

With the following explanation and accompanying diagrams I shall attempt to show what the result would be.

The diameter of the sun is known to be roughly 866,000 miles, and the speed of light to be 186,000 miles per second. Now, while the light of the sun appears to come from a disk, it really comes from a curved surface, the center of





which is nearly 433,000 miles nearer us than the edges. Let A, ~, A' be the visible portion of the sun. (The figure is a cross section.) Then the light from the point B has a shorter distance to travel to the surface of the earth by 433,000 miles, or more than 2.3 *light seconds*. Therefore, the light from B reaches the surface of the earth 2.3+ seconds before the light from A, A'.

Now, supposing the light all over the sun should cease instantly. The light from B would stop 2.3+ seconds *sooner* than the light from A, A'.

Therefore, if the sun were suddenly annihilated, if one were observing at the time, about eight minutes (the time light takes to travel from the sun to the earth) after the sun would appear black at the center, gradually increasing, until 2.3+ seconds after the sun began to grow black, it would be entirely invisible.

Viola, Idaho. K. M. ADAMS.

Why do Not Human Eyes Shine at Night?

To the Editor of SCIENTIFIC AMERICAN:

When hunting at night, one can see the eyes of animals shine pale green or red, when artificial light in directed on them; the same is seen when motoring at night with sheep, cattle, dogs, cats, etc. But this is *never* seen with human eyes. Why is it? The eyes seem to be made exactly alike. I think the above subject has never before been discussed, in fact, when I speak to anyone about it they say they have not noticed it. WALTER WINANS.

Surrenden Park, Pluckley, Kent.

[Your question "Why do Not Human Eyes Shine at Night?" is not difficult to answer. The coat of the eye which carries the blood vessels, otherwise known as the *choroid coat*, is locally differentiated into a structure called the *tapetum*. This tapetum, situated on the back portion of the choroid coat, varies widely in different animals, both in appearance and detail of structure.

In the cat the tapetum, formed by a layer of cells containing crystals, is of a brilliant blue or green color, and it is the reflection and incident iridescence of light falling on this area that causes the eye to "shine" in the so-called dark.

I have kept a cat's eye preserved in

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Then, No-Rim-Cut tires are 10 per cent oversize. That is due to the fact of the hookless base. These tires are not hooked to the rims.

That means 10 per cent more air—10 per cent greater carrying capacity. And that, with the average car, adds 25 per cent to the tire mileage.

With these tires you save rim-cutting. You save the blowouts due to overloading. You get extra capacity without extra cost. For these patented tires now cost no more than other standard tires.

The result of this is, under average conditions, to cut tire cost one-half.

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Now we have added, for those who want it, a double-thick Non-Skid tread.

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No-Rim-Cut tires with this Non-Skid tread put an end to rim-cutting, an end to skidding and an end to overloading. And those are the three greatest tire troubles.

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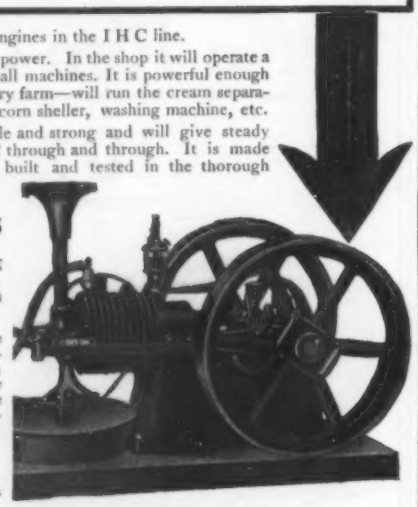

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glycerin jelly for five years, which still shows undiminished iridescence when a ray of light is allowed to fall upon its tapetum. The eye of a horse kept for a like period gives the same result.

In man the tapetum is insignificant, and therefore the phenomenon of "shining" at night is not observed. Between the tapetum of man and that of the cat we find all grades of development in the other mammals, and a critical examination will show that the degree of "shining" in the dark will vary according to this development. R. W. TOWER, Curator of Physiology, American Museum of Natural History, New York.]

Association of Variable Star Observers

To the Editor of SCIENTIFIC AMERICAN:

Notice is hereby given that an association of variable star observers has recently been organized in this country. All those interested in astronomy possessing telescopes of three inches aperture or larger are cordially invited to co-operate in this work. This plan has received the indorsement of Prof. E. C. Pickering, director of the Harvard College Observatory, and monthly reports of the work of this association are sent to the Harvard Observatory. Here is an excellent opportunity for observers to render science practical aid, and use their telescopes to good advantage. The work is not difficult, involves no mathematics, and requires no experience. Those desiring further information respecting this line of observation work are requested to address WILLIAM TYLER OLCOTT.

Norwich, Conn.

Zeppelin's "Schwaben"

(Concluded from page 472.)

honored aeroplane rudders, fore and aft, were removed—quite a revolutionary step, because they had always proved efficient. Only one set of them was now attached to a more graceful single rudder frame at the extreme rear, where they were combined with vertical rudders and cleverly supported by the stabilizing fins. It was found that thus friction and head resistance was cut down, steadiness improved and the efficiency of all rudders wonderfully increased, for the big ship could now be turned completely within a circle of only 1,600 feet in diameter. It was surprising that the lifting power of the ship suffered nothing from the removal of its "aeroplanes;" the kite effect of the smooth cylindrical hull so well replaced theirs that instead of falling below the floating power of the "Deutschland," that of the "Schwaben" was essentially increased by her greater speed. The inefficiency of an aeroplane which is very long in its line of motion, is improved in a dirigible by the small weight it has to carry dynamically per square foot of its immense surface. Incessant experimenting with propellers is going on in the Zeppelin laboratory, and the "Schwaben's" large four- and two-bladed ones showed increased efficiency. The brackets holding them were cleverly robbed of much head resistance and turned into useful and ornamental steadying fins by a cloth covering. Structural strength was increased at the essential points. The cars and the cabin were built of corrugated aluminium. The size and strength of the pneumatic buffers under the cars was increased. The success of the "Schwaben's" many passenger trips is not only due to her own greater power, but also to perfected methods of handling rigid dirigibles. There are mechanical docking devices in the new sheds which hold the ship securely until it is safe in the open air, so that it may enter and leave without danger. A rail on each side of the shed runs far out into the open through each of the doors at both ends. Each length of rail is made of two narrow channel plates, rivetted together back to back. Two sets of rollers run on each rail, each set bearing against the underside of the upper flanges. Four steel cables depending from the airship's frame can be made fast to the four sets of rollers and may all be slipped simultaneously. The two rails are so far apart that a dirigible lashed to them cannot be swayed if it has sufficient lift, and this may be obtained by removing passengers and bal-

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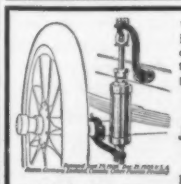

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last during the time that the airship is pushed in or out of its shed. Starting a flight means simply to take aboard passengers and ballast after the ship is at a safe distance from the menacing walls of the shed, and instantly to release all the hawsers. But entering the shed with a brisk wind blowing at right angles to its axis and to the rails is more difficult. In this case the ship is halted in the open over the track, pointing into the wind. One of the front cables is fastened to the rollers nearer the shed on the windward rail. With this set of rollers as a fulcrum the ship is worked around by pulling at the rear end, steadying it along the sides, and simultaneously pulling the lee side down, until it becomes parallel to the rails. It is then a simple matter to fasten the remaining cables, unship passengers and ballast, and roll the ship as safely into the shed as though it were a train of railroad cars.

It may be worth noticing that this device is the same, though more primitive and still depending on the co-operation of a great number of men, as the one suggested in the SCIENTIFIC AMERICAN directly after the accident to the "Deutschland II."

Of equal importance to the docking of these big ships is their safe anchoring where there are no sheds. A safe anchorage over unobstructed grounds, mostly parade grounds, has now been prepared near almost every German city. The holding device is a development of the method by which in the past severe squalls occasionally have been weathered. It is different in so far that the pivotal point around which the ship freely swings into the wind's direction is now not on the ground but in the ship's own frame. Even with the short single bow cable formerly used successfully, jerks which strained the frame and the cable were not entirely avoided in gusty winds. (Too much play for the bow in the accident at Limburg snapped the long cable and freed the ship, though it did not damage the frame.)

In place of one cable there are now four, giving greater safety. They are part of the ship, and may be seen hanging from the bow. They are fastened to a ring that pivots around a strong pin in the reinforced framework. To anchor the ship, they are made fast with their free ends to four heavy cubes of concrete, each 3¼ feet in diameter, sunk into the ground, and so arranged that the four cables evenly radiate toward them from their pivot on the bow. Thanks to its rigidity, the ship now turns around the apex of this pyramid of cables, as smoothly as a new weather vane around a steeple. Unshipping ballast at the bow makes this pyramid very rigid.

Weather "Kiosks" at Home and Abroad

(Concluded from page 477.)

maximum and minimum thermometers set, etc., by an employee of the local Weather Bureau station.

As a substitute for the ill-exposed and often ill-constructed drug-store thermometer the kiosk amply justifies its existence in providing an accurate record of the conditions to which the urban population is exposed. In hot weather the thermometers in the kiosk read many degrees higher than those of the regular Weather Bureau station. The following comparison of maximum readings during a summer hot spell at Washington is instructive:

July, 1911.	Weather Bureau Observatory.	Kiosk.
	Degrees Fahrenheit	Degrees Fahrenheit
2	97.7	105.0
3	99.1	106.5
4	96.7	105.0
5	97.8	104.5
6	98.3	105.5
7	95.0	102.7
8	84.2	93.5

When a brisk wind is blowing the difference between observatory and kiosk temperatures is less than shown by the above comparison. The propriety of artificially ventilating the kiosk—the plan adopted in a type of kiosk used in Germany, as described below—has been con-

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sidered. It is a question, however, whether the structure with this modification would answer so well the purpose for which it is intended; since the populace, whose environment the kiosk instruments are designed to gage, does not habitually carry an electric fan about the streets, nor even continually wield the palm-leaf in the busy round of daily occupations. On the other hand, neither is the populace inclosed in a cast-iron cage, and possibly finds itself more comfortable in hot weather than would the kiosk thermometers if they had human sensibilities; so that the question of artificially ventilating these structures may be regarded as an open one.

The meteorological kiosks of Europe, in contrast to those just described, are not maintained by the official meteorological services of the several countries. Some have been erected by instrument-makers, as a means of displaying their wares; others are installed at health-resorts, as an attraction to visitors; but the majority are mere sign-boards for the display of miscellaneous advertisements, which occupy most of the surface space, the instruments being relegated to any odd corner that can be spared. Their architecture varies according to the taste of the designer, without, as a rule, any regard to the proper exposure of the apparatus. Some of these structures, especially those erected by the municipalities, are most imposing—to look at. One built some twenty years ago by the city of Berlin cost 7,000 marks ($1,666). In this structure the instruments were installed behind glass in shallow unventilated panels, and in summer all of them were exposed during part of the day to direct sunshine. The apparatus included a mercurial barometer hung at such an elevation that no one could read it without the aid of a step-ladder. All the instruments were grossly neglected, and those that should have shown identical readings exhibited instead the most remarkable discrepancies.

Latterly, however, certain foreign instrument-makers, especially in Germany, have turned their attention to the production of kiosks satisfying scientific as well as popular and artistic requirements. Probably the first German kiosks to be constructed according to scientific principles were those erected in Berlin about 1891 by the Urania Uhren- und Säulen-Gesellschaft, and known as "Uraniasäulen." (Fig. 4.) These were intended primarily for displaying advertisements, but contained well-constructed and well-exposed meteorological apparatus, ventilated by a clockwork-driven fan, according to the principle of the Assmann aspiration-psychrometer. Unfortunately the Urania Company did not have a long career; the kiosks were bought by the municipality, and in most cases deprived of their instruments. In a few, however, the instruments are still kept in operation.

Excellent weather kiosks are now manufactured in Germany, though one sees plenty of the opposite kind at the "Kurorte" and other frequented places in that country. The type of kiosk constructed by R. Fuess, of Steglitz, near Berlin, is shown in Fig. 3. This contains a barograph, hygrograph, and thermograph, the pens of which trace their records on a sheet of paper wound around a single revolving drum. The apparatus is ventilated, according to the Assmann method, by a revolving fan, driven by electricity or water-power—usually the latter. Kiosks are also manufactured on a large scale by W. Lambrecht, of Göttingen (Fig. 1) and usually house some of his special instruments; such as the "polymeter" and the "weather-telegraph." The latter comprises a particular form of hygrometer and an aneroid barometer, the dials of which stand side by side; while underneath is a series of diagrams which, it is claimed, enable one to forecast the weather from the indications of the two instruments.

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(Concluded from page 479.)

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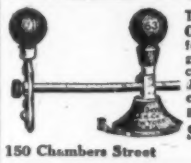

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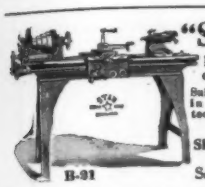

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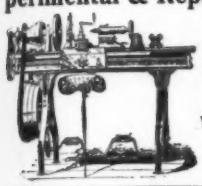

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economics laid down in such a course has the assurance of being in demand as long as this country remains a great industrial nation. In these days, when the industrial needs of the land are growing so rapidly, the demand for electrical engineering graduates who come from the best planned and administered engineering schools is very great, and, as long as the industrial growth of the nation continues, the demand will continue to absorb all well trained young men that the schools can supply.

An experienced engineer should have the ability to conceive, originate and direct extended industrial enterprises. To attain this ability requires many years of mature experience, and an electrical engineering course that is expected to promote the highest welfare of its graduates must be largely occupied with teaching the principles of science, i. e., the purport of known natural laws and their relations to each other. Young men with this sort of a training are not seasoned engineers, but they have the training which gives them great capacity for becoming engineers and after sufficient experience in actual practice of obtaining the highest rank consonant with their individual abilities. This great capacity for becoming efficient engineers through the seasoning effect of experience, which engineering graduates possess, is a sufficient reason for their being in demand. Such graduates have opportunities for professional usefulness in many branches of electrical engineering.

In telephony the work is primarily one of unending detail; but it may lead to broad and comprehensive executive duties in connection with one of the great servants of commerce, and the telephone service offers so many opportunities of benefiting the public that it has attracted a great many able men to its ranks. In electric railroading is found a rapidly growing branch of service that appeals to the imaginations of many. There are opportunities in it leading to executive duties in a branch of industry that composes the very backbone of commerce. With the present tendency toward electrification of the great terminals and mountain divisions of trunk line steam railroads and even of their main stems, the graduate of an electrical engineering course who goes into railroading with the firm purpose of learning the best processes of handling traffic has possibilities of a great career before him.

Similar attractions are found in electric light and electric power transmission, and attractions of other kinds and unending variety are found in the manufacturing industries; but it should be remembered that most of the men capable of deserving the highest positions within the sphere of electrical engineering practice must expect to become either men of executive force or men who originate new projects or machines. In either of these vocations it will be found that far more than a trades education is needed and that the appropriate education must be, broadly speaking, the education of a gentleman, a man of the world, and a scientist. Such men find use for all of the scientific studies already named and also for the training in language, history and political science which has now come to an honored place in the curricula of a few of our engineering schools.

There is also at the present time a considerable call for competent teachers in electrical engineering courses, and the work of research in regard to electric and magnetic phenomena is growing rapidly and is calling for workers.

When the field of electrical engineering is examined in this manner, and the experience of the able young men who are now graduating year by year from the electrical engineering schools is compared, there can be no other conclusion reached than that electrical engineering as a profession offers opportunities for those who have industry and a taste for science and business which are not excelled in any profession or branch of business. Experience shows that there are opportunities in electrical engineering for all well trained young men who possess good sense and industrious habits, and particularly for those who have the ambition, capacity and industry to digest a course at one of those few schools which stand in the first rank of scientific accomplishment and earnest endeavor.

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Mr. Loening, who has come in intimate contact with many of the most noted aviators and constructors and who has made a profound study of the subject for years, is unusually well informed, and is widely recognized as an expert in this line. In a clear and definite style, and in a remarkably thorough and well-arranged manner he has presented the subject of aviation. The scientific exactness of the valuable data and references, as well as the high character of the innumerable illustrations and diagrams, renders this work easily the best and the most useful, practical and complete that has ever been contributed to the literature on aeroplanes.

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